

12. *Notes on Dragon-flies (Odonata) of the S.W. Cape, with Descriptions of the Nymphs, and of New Species.*—By K. H. BARNARD, D.Sc., Assistant Director.

(With 32 Text-figures.)

THIS is the tenth report on the Fauna of the Mountain Ranges of the Cape Province, for the investigation of which I have received grants from the Royal Society of South Africa and the Research Grant Board.\* My thanks and acknowledgments are herewith tendered to these bodies.

Both from a general faunistic point of view, and also in connection with the food of trout and other fishes, dragon-flies are of considerable importance. During the course of my researches on the Mountain Fauna much material and many observations have been collected. Additional occurrences and localities of several species since the publication of Ris' monograph of the South African Odonata (1921, Ann. S. Afr. Mus., vol. xviii) have accumulated and are worthy of record.

The main purpose of this paper is to describe the nymphs (larvae, or naiads) of the Cape species, only one of which was available for inclusion in Ris' work.

Only those species occurring in the S.W. Cape, roughly within a radius of 200 miles from Cape Town, have been included, as I have had no opportunities of investigating the life-histories of the more tropical forms. The fauna-list for this area includes 39 species and 2 varieties, of which 4 species and 2 varieties are described as new. The nymphs of 24 of these have been discovered; in terms of genera, the nymphs of only 4 genera out of 22 remain to be discovered (viz. *Lestes*, *Ceriagrion*, *Palpopleura*, *Sympetrum*).

\* Previous reports: 1. "Freshwater Crustacea," Trans. Roy. Soc. S. Afr., vol. xiv, 1927. 2. "Colophon (Coleoptera)," *ibid.*, vol. xviii, 1929. 3. "Alder-flies," *ibid.*, vol. xix, 1931. 4. "May-flies," *ibid.*, vol. xx, 1932. 5. "Terrestrial Isopoda (Woodlice)," Ann. S. Afr. Mus., vol. xxx, 1932. 6. "Further New Species of Colophon," Stylops, vol. i, pt. 8, 1932. 7. "A New Corduline Dragonfly," *ibid.*, vol. ii, pt 7, 1933. 8. "Caddis-flies," Trans. Roy. Soc. S. Afr., vol. xxi, 1934. 9. "Stone-flies," Ann. S. Afr. Mus., vol. xxx, 1934.

In 1929 Brain (Insect Pests and their Control in South Africa, pp. 159-160) gave a short key to 15 genera of dragon-flies found in the winter-rainfall area. Following the localities given in Ris, he did not include any Gomphines or Cordulines, or the genera *Chlorocypha* (*olim Libellago*) and *Elattonaura* (*olim Disparoneura*).

As regards the imagos, particular attention has been paid to the genitalia of both sexes, and for the sake of comparison several figures of species occurring outside the S.W. Cape area are given. This aspect of dragon-fly taxonomy is one to which far too little attention has been paid in the past. In so many instances where the "♂ genitalia" are figured, it is found that actually only the secondary or accessory structures are figured; and discussions on synonymy take no account of the *penis*, which, as the sequel will show, often offers valuable specific characters.

Once again I have to record the great assistance rendered by Mr. H. G. Wood, who has discovered several new localities for species not hitherto believed to occur so far to the south-west, and who has very generously provided motor transport on our joint expeditions. Mr. A. C. Harrison, Mr. F. G. Chaplin (of the Jonkershoek Trout Hatchery), and Mr. J. C. Dendy have taken an interest in the work from the angler's point of view, and have been of very material assistance. Mr. Harrison was the first to discover a Corduline in South Africa (*Stylops*, vol. ii, 1933), and has bred several of the nymphs recorded in the present paper. My colleagues Dr. A. J. Hesse and Mr. C. W. Thorne have also rendered much assistance.

Mr. Harrison has contributed the following paragraphs on Economics, for which I express my thanks.

#### ECONOMICS.

Dragon-flies may take some part in the control of aquatic insects which are directly harmful to man—such as mosquitoes, or even of orchard pests in the vicinity of streams and dams.

Their importance to inland fisheries depends to some extent upon the food requirements of the fish under consideration. Apart from vertebrates, dragon-flies are the dominant insectivores in many waters, and thus their position in the economy of trout waters is a doubtful one. Trout grow well and attain high condition upon a regular diet of the smaller aquatic insects—such as may-flies, caddises, and chironomids, and dragon-flies must be considered as direct competitors for such food. In stony mountain streams, dragon-fly larvae are usually well concealed from the trout, either on or beneath

the substratum (Aeschnine, Gomphine, and Libelluline nymphs) or in vegetation (damselfly nymphs); and they are not very common in numbers in trout stomachs although they are sometimes prominent in bulk, except when floods have disturbed them from their usual haunts. At such times they occur more numerous along with other large food items—such as alder-fly larvae and river crabs.

In the slower reaches of trout streams, the larvae may play a very useful part in the diet of the larger trout. On 9th May 1936 Mr. Robert Murdock, of Capetown, caught a rainbow trout of  $1\frac{1}{4}$  lb. in the lower Eerste River at Faure, C.P. Its stomach contained 115 *Mesogomphus* nymphs (averaging about  $\frac{3}{4}$  in. long), 10 *Aeschna* nymphs ( $\frac{1}{2}$  in. to  $1\frac{1}{4}$  in. long), and 10 Libelluline nymphs (about  $\frac{1}{2}$  in. long, and probably *Trithemis* sp.); and no other food could be recognised. Another trout of similar size caught at the same time contained a smaller amount of the same larvae.

*Aeschna* and *Anax* nymphs are a direct menace to trout alevins and young fry.

Adult dragon-flies are not usually common in trout stomachs, but on one occasion an adult of the large species *Anax speratus*, the "Great Red Dragon-fly," was found in the stomach of a brown trout of 1 lb. caught in the Witte River, Wellington, during the summer peak of this species. (Several long *Mermis*-like parasitic Nematodes were found loose in the same stomach. Tillyard (1917, p. 331) mentions a *Filaria* found by Selys.)

Dragon-flies are of value as a fish-food in enclosed waters devoted to large-mouth black bass, as, on the whole, these fish require larger food-items than do trout. Libelluline dragon-fly larvae have been found to be a staple aquatic insect food taken by the bass in Paarde Vlei Lake, Somerset West, and some stomachs have contained from 50 to 100 individuals forming in bulk a good meal. The annual visit of the "Migratory Dragon-fly," *Sympetrum fonscolombi* Selys, to Cape waters has been noticed to induce surface feeding by black bass and to improve the fly-fishing. Black bass have been seen to leap right out of the water to take these insects as they flew close to the surface, particularly when the females were going through the actions of ovipositing or flying *in copula* with the males.

#### TERMINOLOGY OF WING VEINS.

Although Ris retained the old system, he was evidently open to receive the new interpretations of Lameere and Tillyard, based on a study of fossil wings. It might be thought convenient to adopt in

this paper the same terminology as in Ris' monograph of the South African Dragon-flies, but one must keep pace with scientific progress. Tillyard's notation, as expressed in his *Insects of Australia and New Zealand* (1926), is therefore adopted here, and the following table will show the chief alterations. Tillyard's *Biology of Dragon-flies* (1917) is such a useful book that the preliminary new notation there used is also included.

Ris 1921.	Tillyard 1917.	Tillyard 1926.
R	R	R <sub>1</sub>
M <sub>1-3</sub>	M <sub>1-3</sub>	Rs
M <sub>1</sub>	M <sub>1</sub>	R <sub>2</sub>
—	M <sub>1A</sub>	IR <sub>2</sub>
M <sub>2</sub>	M <sub>2</sub>	R <sub>3</sub>
Rs	Ms	IR <sub>3</sub>
M <sub>3</sub>	M <sub>3</sub>	R <sub>4+5</sub>
M <sub>4</sub>	M <sub>4</sub>	MA
Cu	Cu + A	Cu <sub>2</sub> + 1A
Cu <sub>1</sub>	Cu <sub>1</sub>	Cu <sub>2</sub>
Cu <sub>2</sub>	Cu <sub>2</sub>	1A
A*	Ab	A'
Cuq	Ac	Ac

The Radial and Median Supplements (Rspl, Mspl) may remain the same, though the latter should really be MAspl. Cu<sub>1</sub>, except in a single fossil form, is regarded as absent in all fossil and recent Odonata (Tillyard, *loc. cit.*, 1926, p. 68, footnote).

#### GENITALIA.

For purposes of the systematics of this paper, attention had already been paid to the penis, and certain structural peculiarities had been noted, when Mr. Harrison gave me a pair of *Ischnura senegalensis* preserved in alcohol, which had remained *in copula*. The study of this pair enabled one to observe the interaction of the several parts of the ♂ copulatory appendages and the ♀ valve and stylets.

The grasping of the ♀ prothorax by the ♂ claspers is well known, but a figure (1*b*) is given of this specimen showing how the ♀ prothoracic ridge is held between the lower and upper ♂ appendages, while the projecting tergite of the 10th segment presses down on the ♀ mesothorax (*cf.* Kennedy, Proc. U.S. Nat. Mus., vol. xlix, p. 296, fig. 89, 1915).

The relation of the parts of the 2nd segment ♂ and the genital segments of the ♀ is shown in fig. 1*c*. The amplexus is actually closer, but for the sake of clearness in the figure the sexes have been pulled slightly apart. The bursa copulatrix or vagina (*b*) (*cf.* fig. 1*d*)

opens between the bases of the stylets on the 8th segment. Both pairs of stylets lie in the anterior pocket of the genital fossa of the ♂, where they are held by the anterior lamina and its posterior processes (Tillyard, Biol. Dragonfl., p. 218). Kennedy (*loc. cit.*, p. 296) says that the anterior laminae fold inwards and that the ovipositor sheath of ♀ does not fit into the depression on 2nd segment of ♂.

Kennedy examined dried material. In the present instance the ♂ anterior laminae undoubtedly clasp and enclose the ovipositor sheath of ♀ (genital valves).

The penis is inserted to the end of the bursa or vagina, with the apical fork recurved and the two spines pointing distally (for a more detailed figure of the penis of this species, see fig. 19).

In all the *Zygoptera* studied in this paper, the penis is strongly curved like a fish-hook, and for the most part is heavily chitinised (see figs. 4, 9, etc.). It is attached at two points (fulcra) in the median line to the membranous and elastic wall of the genital fossa (fig. 1c, h). From the upper (anterior) point of attachment a thickening of the wall of the fossa forms a chitinous strut (*st.*) on either side, which runs downwards and backwards, with an elbow-like articulation, to the posterior hamule. Splaying or an outward lateral movement of the hamules will exert a downward pull on the penis, which will thus be exerted from the fossa to enter the bursa of the ♀.

The heavy chitinisation of the basal portion is continued on the anterior and ventral edges of the penis, but the inner and dorsal surface forms a groove (fig. 1h, *gr.*) bordered by a membranous flange. Useful specific characters may often be found in the sculpturing of the flanges and the presence of spines on the chitinous framework (see figs. 11-13). Kennedy (Ohio Journ. Sci., vol. xxi, No. 1, 1920) has already figured the penes of four South African species (3 genera), but as his purpose was to show the general relationships of the Zygopterous genera his figures are too small for details.

The apical portion is more or less distinctly hinged. The chitinous framework of the basal part is continued as a pair of more or less strongly chitinised plates, and the groove formed by the flanges is continued on to a soft membranous flap of variable extent. Sub-apical, exsertile appendages (distal hook) of manifold shape occur (figs. 9, etc.), which are of specific or even generic importance.

These appendages may be for the purpose of retaining the penis in the bursa, while the sperms or sperm-packets pass down the groove formed by the flanges. How the sperms are propelled is a matter

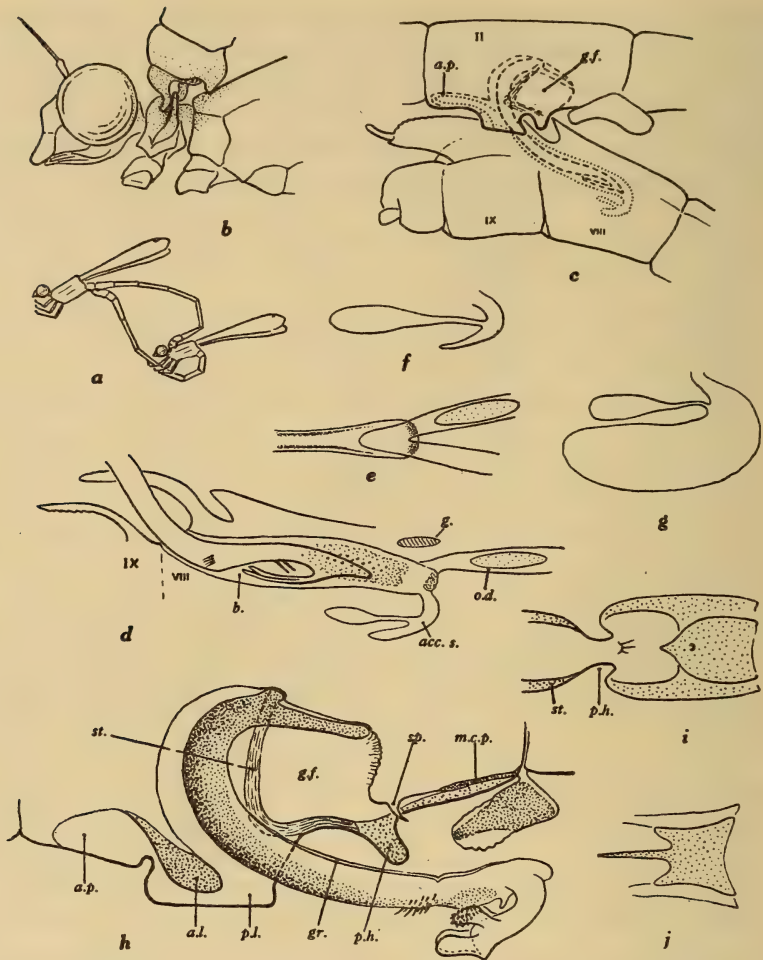


FIG. 1.—*Ischnura senegalensis*. a, ♂ and ♀ in copula. b, apex of abdomen ♂ clasping prothorax ♀. c, optical section of ♂ and ♀ genitalia in copula. d, penis ♂ in bursa, ventral surface of latter uppermost. e, ventral view showing the 2 oviducts entering the bursa. f, g, accessory sacs from other specimens. j, ventral view of median chitinous plate (cf. h, i).  
*Phaon iridipennis*. h, sagittal section of 2nd abdominal sternite ♂, showing genital fossa, penis, and associated structures, and appendage of 3rd sternite.  
*Chlorolestes conspicua*. i, ventral view of median chitinous plate.  
 (acc.s. accessory sac (with or without saccule). a.l., anterior lamina. a.p., anterior pocket. b., bursa copulatrix or vagina. g., 8th ganglion. g.f., genital fossa. gr., groove between membranous flaps on penis. m.c.p., median chitinous plate. o.d., oviduct. p.h., posterior hamule. p.l., posterior lobe. sp., spine. st., strut.)

for conjecture. Possibly the curious structure on the anterior margin of the 3rd sternite may help to perform this function. It would certainly seem to serve the purpose of retaining the sperms in the genital fossa prior to intromission.

This vesicular process of the 3rd sternite appears to be homologous with the "vesicle of the penis" (Tillyard) of the *Anisoptera*. It is heavily chitinised along the sides and basal ventral surface, leaving the whole of the upper (inner) and the lower apical surfaces membranous, and the membranous portion is apparently distensible. In ventral view the membranous area has the appearance of a window (fig. 9). It is filled with a homogeneous tissue, without tracheae, and there is no opening either to the exterior or into the body-cavity. In this latter respect it differs from its supposed homologue in the *Anisoptera*. In repose the apex of the penis is tucked in between this vesicle and the 2nd sternite.

The posterior part of the 2nd sternite is occupied by a chitinous plate (fig. 1, *m.c.p.*), with rather indefinite boundaries in *Phaon*, but in *Chlorolestes conspicua* definitely shield-shaped with a minute tubercle, and in *Ischnura tricuspid*. Chitinous strips flank the median plate on either side and continue to the posterior hamules. Anterior to the plate the sternite is membranous and bears a flexible spiniform process (*Phaon*) (fig. 1, *h, sp.*) or a small knob with 2-3 setules (*Chlorolestes conspicua*).

In one very important point the above description of the Zygopteran penis differs from that given by Tillyard (*loc. cit.*, p. 217), viz. the lack of communication between the penis and the body-cavity. In fact, it would seem that every statement in the last paragraph on p. 217 is erroneous, except that the penis occupies the same position as the Anisopteran sheath, and that it lacks muscles and tracheae. Apparently Tillyard relied on statements by early writers and on "chitin preparations," which latter would be flattened by the coverslip in mounting, thus giving a distorted conception of the structure.

When we examine the bursa copulatrix of the ♀ we find that the impression created by Tillyard's description (*loc. cit.*, p. 221), viz. that the possession of two accessory sacs is a feature common to all dragon-flies, must also be qualified. Here again Tillyard relied on early authorities, and happened to study an example of the *Anisoptera*, which confirmed the earlier work. In all the *Zygoptera* here examined the bursa has only one accessory sac.\*

\* This discrepancy was also noted by George (Quart. J. Microsc. Sci., n.s., vol. lxxii, 1928, pp. 469-470) when studying *Agrion*.

The bursa is a fairly elongate tube, whose diameter in the various genera can be more or less correlated with the robustness or bulk of the subapical appendages on the penis of the respective males (cf. *Phaon*, figs. 1, *h* and 2, *b*, with *Ischnura*, fig. 1, *d*). Its lateral walls are more or less chitinised, chiefly towards the inner end, sometimes (*Phaon*, *Chlorocypha*) forming rather definitely demarcated

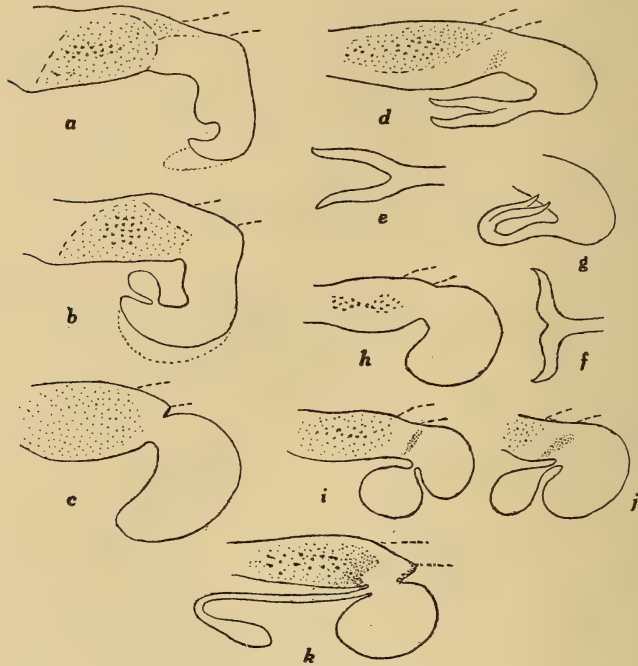


FIG. 2.—Bursa copulatrix (vagina) and accessory sac ♀ of Zygoptera. *a*, *Chlorocypha caligata*. *b*, *Phaon iridipennis*. *c*, *Lestes virgatus* and *plagiatus*. *d*, *e*, *f*, *Chlorolestes conspicua*, with variation in shape of apex of accessory sac. *g*, *C. longicauda*, accessory sac. *h*, *C. peringueyi* and *nylephtha*. *i*, *j*, *Elatoneura mutata* and *frenulata*, respectively. *k*, *Pseudagrion cafferum*.

(In *a-d*, *h-j* the opening of the united oviducts is dotted. Variation in apex of accessory sac indicated by dotted line in *a*, *b*.)

chitinous plates, and as a rule with a patch of minute granules on the internal surface (fig. 2).

The oviducts (*o.d.*) enter the bursa by a common opening on the ventral surface. Between this opening and the dorsal accessory sac is a small (*Ischnura*, *Enallagma*, *Pseudagrion*, *Allocnemis*), or very small (*Lestes*), chitinous patch; in *Elatoneura* and *Chlorolestes*, where the opening of the accessory sac into the bursa is large, there



is a feebly chitinised patch on either side, which in *Phaon* and *Chlorocypha* is scarcely traceable.

The accessory sac (*acc.s.*) in *Ischnura*, *Enallagma*, *Elatoneura*, *Pseudagrion*, *Allocnemis*, *Phaon*, and certain species of *Chlorolestes*, has its own accessory sacculle attached to its posterior surface by a longer or shorter duct. Both the sac and its sacculle are distensible, and vary in size in different individuals of the same species. When largely distended the contents seem to be of a homogeneous glutinous constitution, not spermatozoa. In certain species of *Chlorolestes*, viz. *conspicua*, *longicauda*, *fasciata*, *umbrata*, the sacculle is bifurcate; in two other species, *peringueyi* and *nylephtha*, there is no sacculle at all. It is noteworthy that this difference is correlated with certain differences in the ♂ appendages (see *infra*, p. 191).

In *Lestes virgatus* and *plagiatus* there is also no sacculle; and *Chlorocypha*, in which the whole bursa closely resembles that of *Phaon*, has only a slight distension in the position of the sacculle (the same shape was found in two specimens).

Thus it will be seen that there is considerable variety in the bursa and that it is worthy of further study. The very curious differentiation in *Chlorolestes* and its correlation with features of the ♂ is especially intriguing.

The technique here used involved cutting out only the 8th sternite and underlying tissues, and no attempt was made to examine the accessory glands in the 9th segment noted by George (*loc. cit.*, 1928, p. 469).

Turning to the *Anisoptera* we find that the ♀ bursa possesses two accessory sacs, but that there may be considerable variations in shape; and that previous accounts of the structure of the penis cannot be confirmed.

Both Ingenitzky (Zool. Anz., vol. xvi, p. 405, 1893 \*) and Tillyard (*loc. cit.*, p. 217) maintain that the lumen of the penis opens to the exterior by a pore, on the 1st joint according to the former, on the 2nd according to the latter. If there were an opening one would expect, after treatment with KOH, to be able to press out the softened and disconnected contents (muscles, tracheae) through this opening. Williamson (Occ. Papers, Mus. Zool. Ann Arbor, Michigan, No. 80, 1920, explanation to fig. 8 on pl. 1) says there is an opening on the 1st joint and also one on the (presumably) 3rd, and that in relaxing the specimen air and fluids were discharged through the opening

\* I have not seen the paper in Russian (Warsaw Univ. Bericht, No. 1, 1893) where his results are set forth in greater detail.

on the 1st joint. As he used dried material the possibility of cracking and accidental pricking by dissecting needles is not excluded. For my part, in all the dozens of penes examined for purposes of this paper, including both dried and alcoholic material, I have not been able to squeeze out any contents or to satisfy myself of the existence of any natural opening.

On the other hand, there is an opening at the base of the "bulbus" (Ingenitzky) or "vesicle" (Tillyard) into the body-cavity, through which tracheae, etc., enter the penis, though Ingenitzky (*loc. cit.*, p. 406) says the bulbus is completely shut off from the body-cavity.

The apex of the 1st joint on its dorsal surface, and the dorsal surface of the 2nd joint are much less heavily chitinised than the rest of these joints, being sometimes quite membranous, and this gives the impression of an opening. The dorsal surface of the 2nd joint is more or less grooved (as Ingenitzky correctly states), leading on to the apical joint with its manifold varieties of lobes and processes.

Instead of the bulbous 1st joint (or vesicle) forming a reservoir for the sperms as Ingenitzky maintained, it would seem that the sperms or sperm-packets prior to copulation are merely held in position between the penis, the sheath (Ingenitzky: ligula), and the sternite of the 2nd segment; during copulation they could be pressed along the channel formed by the groove on the 2nd joint of the penis and the opposed sheath, while the apical lobes of the penis distend the vagina. For determination of the actual method, however, one needs a pair preserved *in copula*.

As mentioned above, the ♀ bursa possesses a pair of accessory sacs. Figures are given here of the bursa in most of the genera studied for this paper. In most cases the bursa is shorter than in the *Zygoptera*, but is fairly long in the Aeschnines (*Anax*, *Aeschna*) and the Corduline *Presba*. In the Libellulines there is a dorso-lateral pair of more or less well-chitinised areas, with or without a median connecting band, and anteriorly to them a median projecting chitinous plate. The latter varies in shape in different genera, and apparently serves as a muscle attachment. In the closely allied genera *Trithemis* (*arteriosa* and *risi*) and *Helothemis* (*dorsalis* typical and the var. mentioned *infra*, p. 255) this plate is of the same shape. This plate is absent in *Presba*, *Mesogomphus*, and *Ceratogomphus*, and in the Aeschnines, and in the latter the paired chitinous areas are also absent.

In the Gomphines there is a long chitinous spiniform process at the anterior end of the bursa, dividing posteriorly into a fork. An

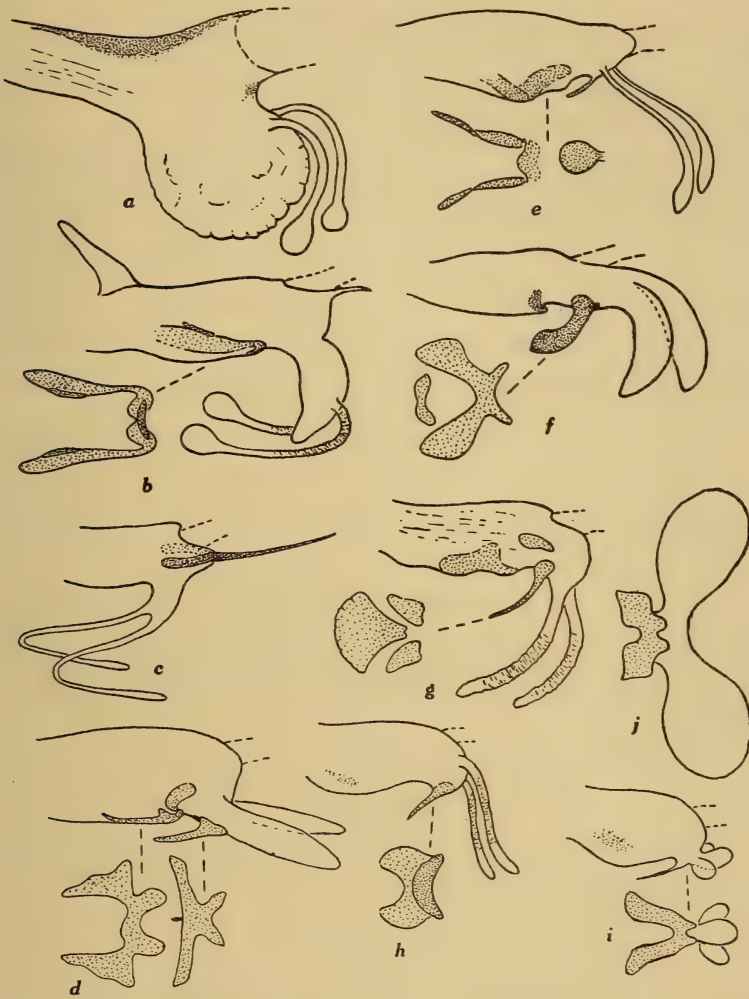


FIG. 3.—Bursa copulatrix and accessory sacs ♀ of Anisoptera. *a*, *Anax imperator mauricianus* and *Aeschna minuscula*. *b*, *Presba venator*, with dorsal view of chitinous plate. The genital valve at upper left-hand corner is abnormally shaped (cf. fig. 1, *c* in original description. Stylops, 1933). *c*, *Mesogomphus cognatus* and *Ceratogomphus pictus*, in latter the anterior chitinous process is longer. *d*, *Pseudomacromia torrida*, with dorsal view of chitinous plates. *e*, *Orthetrum capense*, with dorsal view of chitinous plates. *f*, *Crocothemis erythraea*, with dorsal view of chitinous plates. *g*, *Helothemis dorsalis*, *Trithemis risi* and *arteriosa*, with dorsal view of chitinous plates. The paired plates at base of fan-shaped plate absent in typical *H. dorsalis*. *h*, *Sympetrum fonscolombet*, with dorsal view of chitinous plate. *i*, *Palpopleura jucunda*, with dorsal view of chitinous plate and accessory sac. *j*, *Palpopleura lucia*, dorsal view of chitinous plate and accessory sac.

(The opening of the united oviducts indicated by dotted lines in *a*–*i*.)

indication of such a process, but not chitinised or forked, is seen in *Presba*. In the Aeschnines there is a median chitinous patch in a corresponding position at the end of the bursa, and a median chitinous rod-like thickening of the ventral wall of the bursa.

The accessory sacs in the Libellulines are mostly elongate and slender tubes, transversely wrinkled as if indicating a capacity for considerable distension. Viewed dorsally they spread out laterally and then curve posteriorly like two horns. In one example of *Pseudomacromia* and six *Crocothemis* they were large and of considerable diameter. In *Palpopleura* they are saccoid in shape; in *jucunda* (2 specimens examined) they are all small compared with a median prolongation of the bursa, but in *lucia* (also 2 specimens examined) they are very large and the bursa has no median prolongation.

In the Gomphines the accessory sacs unite and enter the bursa by a common tube of rather large calibre. In *Presba* and the Aeschnines they appear as accessory appendages to a large sac, which in the Aeschnines is enormous; when fully distended this sac must almost fill the whole of the 8th segment.

From the foregoing remarks it will be realised that the genital structures in both *Zygoptera* and *Anisoptera* are in need of much fuller and detailed comparative study. I have not had recourse to serial sectioning, and have confined my study to such genera as are found in the S.W. Cape.

*Key to the genera of the S.W. Cape region: Imagos.*

*Zygoptera.*

- I. Numerous ante-nodal cross-veins. Clypeus (*epistome*) enlarged and projecting. Tibiae of ♂ flattened . . . . . *Chlorocypha*.
- II. Only 2 ante-nodal cross-veins.
  - A. Pterostigma long, covering 2 or more cells. Superior appendages of ♂ forcipate.
    1. Origin of  $R_{4+5}$  nearer to arculus than to nodus . . . . . *Lestes*.
    2. Origin of  $R_{4+5}$  at nodus, or nearer to nodus than to arculus  
*Chlorolestes*.
  - B. Pterostigma short, covering 1 cell. Superior appendages of ♂ not forcipate.
    1. Quadrilateral rectangular.
      - a. IA extending several cells beyond nodus.  $R_{4+5}$  at nodus,  $IR_3$  1 cell distal. Pterostigma cream, end of abdomen orange . . . . . *Allocnemis*.
      - b. IA absent, A' stopping at cross-vein which continues distal end of quadrilateral.  $IR_3$  at nodus,  $R_{4+5}$  1 cell proximal. Pterostigma brown. ♀ with 2 pairs of prothoracic stylets  
*Elatoneura*.

2. Quadrilateral oblique, anal distal angle acute.
- a. Origin of A' at Ac or very slightly proximal. ♀ without spine on 8th sternite.
- i. Colour scheme mostly blue and black. No transverse ridge at frons. Superior appendages of ♂ usually bifurcate . . . . . *Pseudagrion*.
- ii. Colour scheme orange or red. A transverse ridge at frons. Superior appendages of ♂ short, entire  
*Ceriagrion*.
- b. Origin of A' considerably proximal to Ac. ♀ with spine on 8th sternite.
- i. R<sub>3</sub> in fore-wing at 5th or 6th, in hind-wing at 4th or 5th, post-nodal cross-vein. Pterostigma of ♂ alike in fore- and hind-wings . . . . . *Enallagma*.
- ii. R<sub>3</sub> at 4th and 3rd cross-veins respectively. Pterostigma in fore-wing of ♂ black and blue . . . . . *Ischnura*.

*Anisoptera.*

- I. Lateral lobes of labium about equal to median lobe. Triangles similar in both wings, their long axes in long axis of wing. Ante-nodal cross-veins in costal and subcostal areas not coinciding.
- A. Eyes widely separated. Inferior appendages ♂ bifid.
1. No anal loop . . . . . *Mesogomphus*.
2. A distinct anal loop . . . . . *Ceratogomphus*.
- B. Eyes contiguous. Inferior appendage ♂ not bifid.
1. IR<sub>3</sub> forked proximal to pterostigma, more than 2 rows of cells between its branches . . . . . *Aeschna*.
2. IR<sub>3</sub> forked distal to middle of pterostigma, only 2 rows of cells between its branches . . . . . *Anax*.
- II. Lateral lobes of labium very large, contiguous in middle line; median lobe very small. Triangles dissimilar, long axis transverse in fore-wing, longitudinal in hind-wing. Ante-nodal cross-veins coinciding.
- A. Anal border of hind-wing excised in ♂. Auricles on 2nd abdominal segment ♂. Triangle of fore-wing not very narrow.
1. Anal loop short, 3 cells in width . . . . . *Macromia*.
2. Anal loop longer, 2 cells in width . . . . . *Presba*.
- B. Anal border rounded in both sexes. No auricles. Triangle in fore-wing narrow.
1. Arculus at or distal to 2nd Anq. More than 10 Anq in fore-wing, the last one complete . . . . . *Orthetrum*.
2. Arculus proximal to 2nd Anq.
- a. Last Anq in fore-wing complete . . . . . *Helothemis*.
- b. Last Anq incomplete.
- i. Costal margin in fore-wing indented. Wings with black and yellow markings . . . . . *Palpopleura*.
- ii. Costal margin not indented.
- a. Number of Anq 6½-7½ . . . . . *Sympetrum*.
- β. Number of Anq 9½-13½.



- B. Lateral lobes with indents very shallow or obsolete.
1. Eyes small. Lateral margins of head behind eyes parallel. Legs short. Body strongly setose, opaque . . . *Orthetrum*.
  2. Eyes prominent. Lateral margins behind eyes convergent. Legs moderately long. Body sparsely setose or nearly glabrous, more less mottled and semitransparent.
    - a. Abdomen dorsally not keeled . . . *Crocothemis*.
    - b. Abdomen medio-dorsally keeled and toothed.
      - i. Segments 8 and 9 ending in small points. Medio-dorsal teeth large . . . . .  $\left. \begin{array}{l} \textit{Helothemis.} \\ \textit{Trithemis.} \end{array} \right\}$
      - ii. Segments 8 and 9 ending in strong spines. Medio-dorsal teeth small.
        - a. 14-16 mm. . . . . *Sympetrum*.
        - β. 24-26 mm. . . . . *Pseudomacromia*.

FAM. LIBELLAGINIDAE.

1917. Tillyard, Biology of Dragon-flies, p. 274 (*Calopterygidae* part).  
 1926. ,, Insects Austr. N. Zeal., p. 80.  
 1934. Fraser, Fauna Ind. Odonata, vol. ii, p. 1 (*Agriidae* part).

*Imago*.—Wings seldom petiolate. Nodus distant from base of wing. Numerous ante-nodal cross-veins (Anq). Quadrilateral rectangular or nearly so, long, crossed by 1 or more cross-veins.

*Nymph*.—First antennal joint elongate. Gizzard nearly always with 16 folds. Mask with median lobe entire or more or less incised; mental and lateral setae absent. Caudal gills saccoid or triquetral, the median one sometimes short, lamellar, or obsolete. Lateral abdominal gills sometimes present.

Subfam. LIBELLAGINAE.

1934. Fraser, *loc. cit.*, p. 2.

Gen. *Chlorocypha*.

1921. Ris, Ann. S. Afr. Mus., vol. xviii, p. 261 (*Libellago*).  
 1928. Fraser, J. Bombay Nat. Hist. Soc., vol. xxxii, p. 684.  
 1934. *Id.*, *loc. cit.*, p. 55.  
 1936. Longfield, Tr. R. Entom. Soc., vol. lxxxv, p. 467.

*Imago*.—Wings petiolate, hyaline in both sexes. Quadrilateral with only 1 cross-vein. Pterostigma long and narrow in both wings of both sexes. Ante- and post-clypeus (epistome) enlarged and projecting. Sectors of arculus arising separately. MA curved but not zigzagged until at level of or distal to nodus. 1A zigzagged almost from its origin. All tibiae in ♂ flattened and dilated (but not in all species).

*Nymph*.—First antennal joint very elongate, at least twice as long as 2nd, 5 flagellar joints. Mask flat, with median lobe narrowly and not very deeply incised. No lateral abdominal gills. Lateral



FIG. 4.—*Chlorocypha caligata* (Selys). Imago: *a*, dorso-lateral view of right inferior appendage ♂, the upper left-hand hollow being position of insertion of the superior appendage. *b*, penis, with sculpturing of the membranous portion further enlarged. *c*, ventral view of apical lobe of penis. *d*, genital valve ♀, with margin further enlarged. *e*, 3 major and 2 minor folds of the gizzard. Nymph: *f*, head with basal joints of antenna. *g*, dorsal view of XIth abdominal segment with bases of the 2 caudal gills, left cercoid omitted. *h*, lateral view of XIth segment with rudimentary median gill. *i*, ventral view of XIth sternite, with base of 1 gill. *j*, outer view of caudal gill. *k*, portion of mask.

caudal gills triquetral, median gill reduced to a mere conical rudiment. Cercoids prominent. Gizzard with 16 folds. IXth sternite without processes (Anlagen of genital valves).

*Remarks*.—Ris stated that a new generic name would be necessary



for the African species, and in 1928 Fraser proposed *Chlorocypha*. In 1934 he includes the two Asiatic species while expressing doubt as to their being really congeneric. The Indian *vittata* has MA zigzagged almost from its origin, and quadrilateral with 3 cross-veins (Fraser, *loc. cit.*, p. 56, fig. 19). If future students consider it advisable to separate them, a further new name will be required for these two species, leaving *Chlorocypha* solely for the African species.

Karsch (Berl. Ent. Zeitschr., vol. xxxviii, 1893) described two forms of nymphs from Togoland (figs. 10 and 11), both of which he was inclined to assign to "Libellago." Tillyard (*loc. cit.*, p. 275) and Ris (*loc. cit.*, p. 262) have accepted only one of these (fig. 11) as being in all probability the nymph of "Libellago." This is confirmed by Fraser's discovery of the Indian nymphs, and by the South African nymph described below. In the Togoland nymph only 1 of the triquetral lateral gills was present, and Karsch consequently did not appreciate the fact that the median gill was not merely missing in his specimen, but normally quite rudimentary.

In 1928 Fraser (*loc. cit.*, p. 691, pl. iii) described three species of Libellagine nymphs: two of *Rhinocypha* and one of *Libellago* (*sensu stricto*). These agree in all essentials with the present nymph. The XIth tergite is present as a short conical or spiniform *appendix dorsalis* in *Rhinocypha*, but does not appear in the figure of the *Libellago* nymph. In the latter the cercoids are represented, but not in the two figures of *Rhinocypha*. The gizzard has 16 folds, each bearing 4-5 teeth. Fraser's accounts of the antennae, and his figures are conflicting (see 1928, *loc. cit.*, p. 691, pl. iii; and 1934, *loc. cit.*, pp. 4 and 5).

#### *Chlorocypha caligata* (Selys).

1908. Ris in Schultze's Reise, vol. i, p. 307.

1921. *Id.*, *loc. cit.*, p. 262, fig. 6; and pl. vi, fig. 6.

*Imago*.—All tibiae of ♂ dilated. A figure of the lower appendages of ♂ is given here because the teeth (4-6) on the inner upper margin are indistinctly represented in Ris' figure. Penis as in fig. 4, *b*, *c*. Gizzard with 16 folds, 8 major (of which 4 are shorter than the other 4) and 8 minor, each fold with 2 series of recurved spine-like teeth.

*Nymph*.—Up to 18-19 mm. plus gills 6.5-7 mm. (only empty shucks examined). First joint of antennae equal to anterior width of mask,  $2\frac{1}{2}$  times the length of 2nd joint, the 5 flagellar joints decreasing in length, the 5th minute. Mask extending back to bases

of fore-legs; median lobe moderately convex, crenulate, with short cleft, lateral margins with strong spines each on a scute-like base; inner margin of lateral lobes feebly crenulate. A small conical tubercle on each side of prothorax, a little above insertions of legs. Median gill (XIth tergite) rudimentary, merely a short conical process. Lateral gills elongate ( $2\frac{1}{2}$  times width of last abdominal segment), terete, triquetral, all three edges armed with strong spines and setae. The two halves of the XIth sternite (to which the lateral gills are attached) are produced in triangular lamellar processes. IXth sternite without any trace of the valvules or ovipositor surrounding the genital pores of imago. Gizzard?

*Localities.*—In addition to the localities mentioned in Ris, I have seen examples from Port St. Johns, Pondoland; and from two localities in the S.W. Cape: Palmiet River, near Kleinmond, Southern Hottentots Holland Mts. (H. G. W., December 1931, 1933; K. H. B. and H. G. W., December 1934), and Tradouw Pass, near Swellendam (A. J. Hesse, November 1925).

*Remarks.*—There are no differences in the ♂ appendages or penis between the Cape specimens and those from Zululand identified by Ris. The discovery of the Palmiet River colony and of the very interesting nymph is due to Mr. H. G. Wood, who in 1933 obtained two empty shucks. In December 1934 Mr. Wood and myself visited the locality with a view to obtaining living nymphs. The search, however, was unsuccessful, although all possible habitats were examined, not forgetting Fraser's remarks (*loc. cit.*, 1928, p. 691, and 1934, p. 4) on the habits of the Indian species.

I have therefore figured a portion of the gizzard of the imago. Tillyard (1917, *loc. cit.*, p. 107) says that in the imago the gizzard and its dentition is considerably reduced, though least in the *Calopterygidae* and *Agrionidae*. As the dentition in the imago *C. caligata* is by no means feeble, that of the nymph may be expected to be somewhat more powerful. Probably it will be found to be easily distinguished from that of the Indian species of *Rhinocypha*, which Fraser says has only 4–5 teeth on each fold.

Apparently no trace of the gizzard remains in the nymph-shuck after emergence of the imago. The gizzard belongs to the fore-gut and is presumably drawn out through the mouth of the emerging imago, while the hind-gut is drawn out through the vent. The latter portion of the digestive canal remains in the nymph-shuck, and in the *Anisoptera* even the delicate "branchial basket" can be dissected out. But even in robust species of *Anisoptera* (e.g. *Orthetrum*,

*Pseudomacromia, Presba*) I have not found the remains of the fore-gut including the gizzard. It would be interesting to know what becomes of it, as it is the one character lacking in the nymph-shuck which prevents one from giving a satisfactory diagnosis of the nymph based on an empty shuck. Probably the examination of a series of examples of nymphs fixed immediately before emergence of the imago, and during the early phases of emergence, would provide a solution of the problem.

The imagos settle on rocks in mid-stream, with the wings folded over the abdomen. Pairing or oviposition has not been observed.

FAM. LESTIDAE.

1917. Tillyard, *loc. cit.*, p. 276.

1933. Fraser, Fauna Ind. Odonata. I., p. 18 (*Coenagriidae* part).

*Imago*.—Wings petiolate. Only 2 ante-nodal cross-veins (Anq). Pterostigma large, covering 2 or more cells. Short intercalary veins between distal ends of longitudinal veins. Quadrilateral with anal distal angle very acute. Superior appendages of ♂ forcipate.

*Nymph*.—Slender. Legs long. Caudal gills in form of simple lamellae. Gizzard with 8 major folds, each bearing a few large teeth.

Subfam. LESTINAE.

1917. Tillyard, *loc. cit.*, p. 277.

1933. Fraser, *loc. cit.*, p. 27.

*Imago*.—Arculus midway between base of wing and nodus. Sectors of arculus arising high up near R. Origin of  $R_{4+5}$  much nearer to arculus than to nodus. Origin of A' at Ac.

*Nymph*.—Mask elongate, with incised median lobe; lateral lobes irregularly cleft; mental and lateral setae present. Caudal gills with secondary tracheae at right angles to main axis.

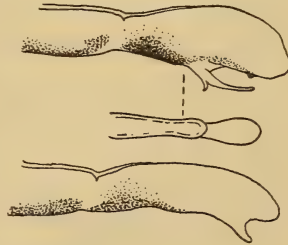


FIG. 5.  
*Lestes plagiatus* (Burm.) (upper)  
and *virgatus* (Burm.) (lower).  
Apex of penis, with ventral  
view of linguiform process of  
former.

Gen. *Lestes* Leach.

1921. Ris, *loc. cit.*, p. 268.

1933. Fraser, *loc. cit.*, p. 29.

It is not proposed to deal with the South African species of *Lestes* as only one species has yet been found in the S.W. Cape. Kennedy, however, has proposed to

separate *L. virgatus* under the generic name *Africalestes* (1920, Ohio Journ. Sci., vol. xxi, p. 84), and so a brief discussion of its validity may be included, together with figures of the penis.

*Africalestes* is defined as having the venation of *Chalcolestes* (*L. viridus*), i.e. differing from *Lestes* in that the upper half of the arculus equals the lower half;  $IR_2$  is nearly straight throughout its length; the penis has a "strap-like inner fold as in *Ceylonolestes*" (the latter n.g. has "penis with a spiral strap on the terminal lobe").

The equal division of the arculus by the sectors is a character in conflict with Tillyard's definition of the *Lestinae*, and, moreover, all the South African Museum specimens of *virgatus* and *plagiatus* have the sectors arising high up near R.

In some specimens of *virgatus*  $IR_2$  is nearly straight, but in others distinctly zigzag; intermediate stages are found, and the wings on opposite sides of the same individual are not always symmetrical in this respect. Specimens from the same locality vary. The same variability is found also in *plagiatus*.

Examination of the penes of 3 examples each of *virgatus* and *plagiatus* shows a strap-like projection in *plagiatus* but not in *virgatus*, though the latter was made the genotype.

In view of the above conflicts I consider that the validity of *Africalestes* is very doubtful.

The nymphs of the South African species are not known (for figure of a European species see Ris, *loc. cit.*, pl. xii, fig. 1).

#### *Lestes plagiatus* Burm.

1921. Ris, *loc. cit.*, p. 276, fig. 13; and pl. vi, fig. 8.

*Locality*.—Knysna (H. G. W., January 1936, 1 ♂).

This is the first record of a species of *Lestes* so far to the south-west in the Cape, the nearest hitherto being Dunbrody (Uitenhage district).

The penis agrees with those of the 3 specimens (identified by Ris) mentioned above. The apical lobe is spatulate, concave dorsally, and the two heavily chitinised areas at its base are connected by a less strongly chitinised horseshoe-shaped band which forms a slight ridge ventrally.

#### Subfam. SYNLESTINAE.

1917. Tillyard, *loc. cit.*, p. 277.

1933. Fraser, *loc. cit.*, p. 19.

*Imago*.—Arculus nearer nodus than to base of wing. Sectors of arculus arising a little above half-way along arculus. Origin of

$R_{4+5}$  at or slightly proximal to subnodus (usually). Origin of  $A'$  distal to  $Ac$ .  $Cu_2$  at its origin from quadrilateral strongly curved towards costa.

*Nymph*.—Mask with incised median lobe; lateral lobes narrow, cleft into 2 teeth, movable hook long and slender; no lateral or mental setae. Pedicel of antenna elongate. Caudal gills with secondary tracheae oblique to main axis.

*Remarks*.—This subfamily is only found in South Africa and Australasia, and according to Tillyard is a survival of the palaeogenic fauna. *Chlorolestes* is characteristic of the Cape mountain ranges, although extending to Natal, Zululand, and the Transvaal.

Gen. *Chlorolestes* Selys.

1862. Selys, Bull. Ac. Roy. Belg., ser. 2, vol. xiv, p. 33.

1920. Kennedy, Ohio Journ. Sci., vol. xxi, p. 84 (*Euchlorolestes*).

1921. Ris, *loc. cit.*, p. 279.

1933. Fraser, *loc. cit.*, pp. 19, 20.

*Imago*.—Wings petiolate to level of quadrilateral (discoidal cell).  $IR_3$  and  $R_{4+5}$  arising nearer to nodus than to arculus. Nervures at end of wing strongly curved downwards towards hind margin. ♂ claspers with or without a basal tooth; inferior appendages entire or bifid; penis with or without an exsertile distal hook. Posterior hamules well developed. Accessory sac of ♀ bursa copulatrix with a bifurcate saccule, or without a saccule (see p. 177).

*Nymph*.—First joint of antenna long and slender, but not as long as 2nd. Cercoids acute, conspicuous. Pedicel of caudal gills flattened, forming part of the gill lamella, gills not caducous. Gizzard with 8 major folds, no minor folds.

*Remarks*.—In the thoracic coloration all the species are much alike, except *peringueyi*. In venation there are some useful specific differences. All species except *umbrata* have 2 or 3 rows of cells in the area between  $IR_2$ – $R_3$  (at level of pterostigma). All species have a single row of cells between  $IR_3$ – $R_{4+5}$  except *conspicua*, which has 2 rows. Two pairs of veins,  $R_3$  and  $IR_3$ ,  $R_{4+5}$  and  $MA$ , are subparallel in *umbrata*, *peringueyi*, and *nylephtha*, but divergent in the other species.

The following revised key has been based mainly on the venation and the ♂ genitalia. The two species *peringueyi* and *nylephtha*, form a group sharply marked off from the rest. Another group is formed by *fasciata*, *tessellata*, and *longicauda*.

Kennedy (*loc. cit.*, p. 84) has proposed the genus *Euchlorolestes* to include *fasciata*, *tessellata*, and *longicauda*, based on the shape of the distal hook of the penis, and the position of Ac in relation to the first Anq. There is undoubtedly a clear distinction between this group and *conspicua*, but it does not seem to call for generic separation because, in my opinion, the difference between the *conspicua* and *fasciata* groups are less striking than those between the *conspicua-fasciata* group and the *peringueyi* group.

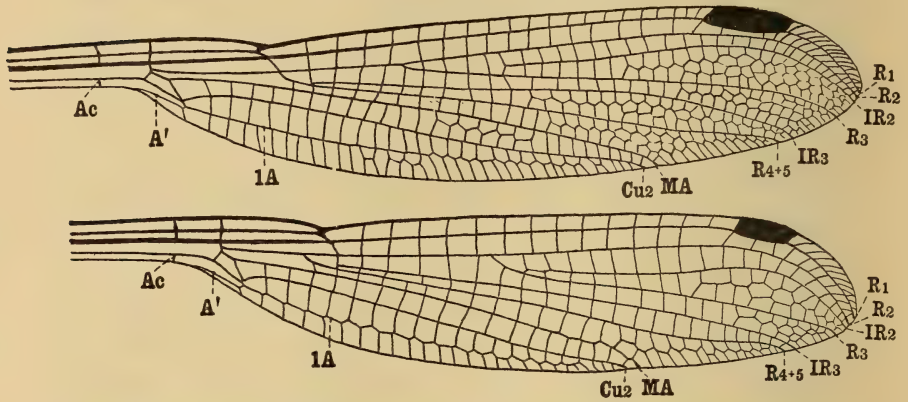


FIG. 6.—Fore-wings of *Chlorolestes conspicua* ♂ (upper) and *peringueyi* (lower).

The position of  $R_{4+5}$  is surely more important than the position of Ac, which is never quite constant even in the same species (see e.g. *conspicua* and *peringueyi*). With the position of  $R_{4+5}$  are correlated the characters of the ♂ claspers, the penis, and the accessory structures of the ♀ bursa copulatrix.

The present grouping of the species was worked out, before seeing Kennedy's paper, and there seemed no occasion to multiply names. Since, however, the *fasciata* group has been named, there is no avoiding a name (*Ecchlorolestes* nov.) for the more important *peringueyi* group.

The interrelationships of the species are far better visualised by keeping all of them in one genus.

In addition to that of *conspicua*, the nymphs of *umbrata*, *longicauda*, *peringueyi*, and *nylephtha* have been correlated. That of *umbrata* does not attain so large a size as that of *conspicua*, but otherwise there are no tangible specific differences between any of the species. The acute points to the lateral abdominal keels are less well developed in *longicauda* than in other species, but as in these latter there is often variation, this character should not be used.

A noticeable feature of the gills in comparison with those of Agrionid nymphs is the flattening of the "pedicel," so as to form part of the gill lamella. At first sight the gill appears to be 2-jointed or nodate. But these basal portions correspond with the chitinous rings which support the gills in Agrionid nymphs, and are really the remnants of the XIth segment (see Tillyard, 1917, Biol. Dragonfl.,

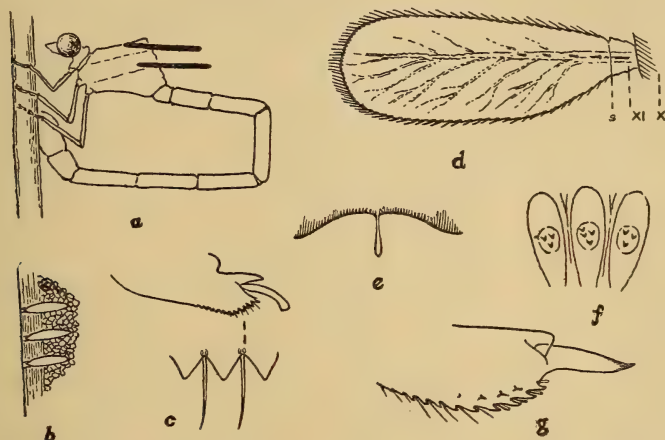


FIG. 7.—*Chlorolestes conspicua* Selys. Imago: a, ♀ ovipositing in stem of reed. b, reed stem cut open to show 3 ova. c, genital valve ♀, with margin further enlarged. Nymph: d, Xth abdominal segment with XIth tergite and median gill, showing suture (s). e, anterior margin of median lobe of mask. f, 3 major folds of gizzard. g, genital valve ♀.

fig. 39, H, J.). In Agrionid nymphs the gills break off very easily at the junction between gill and basal supporting ring, whereas in *Chlorolestes* the gills are not caducous.

*Key to the species of Chlorolestes.*

I.  $R_{4+5}$  at subnodus. Claspers (superior appendages) ♂ without either basal teeth, or lobes on inner margin. Penis with a distal hook. Accessory sac of ♀ bursa with bifurcate saccule (fig. 2d).

*Chlorolestes (sensu stricto).*

A. Inferior appendages ♂ not bifid. Distal hook of penis apically acute. Pterostigma unicolorous.

1. Larger. Hind-wing 32-37 mm. Wings never banded. Yellow stripe on mesepisternum entirely dorsal to humeral suture. Veins  $R_3-IR_3$  and  $R_{4+5}-MA$  evenly diverging *conspicua* Selys.

2. Smaller. Hind-wing 22-25 mm. Wings when fully mature banded. Yellow stripe on mesepisternum embracing the humeral suture.  $R_3-IR_3$ , and likewise  $R_{4+5}-MA$ , subparallel (except near margin) . . . . . *umbrata* Selys.

- B. Inferior appendages ♂ bifid. Distal hook of penis with spatulate apex. Pterostigma bicolorous. Ac distal to 1st Anq . . . *Euchlorolestes* Kenn.
1. Metepimeron with dark (metallic) stripe adjoining the 2nd lateral suture . . . . . *fasciata* Burm.
  2. Metepimeron wholly pale, with only indistinct traces of dark patches.
    - a. Wings banded . . . . . *tessellata* Burm.
    - b. Wings hyaline . . . . . *longicauda* Burm.
- II.  $R_{4+5}$  proximal to subnodus. Claspers ♂ with basal tooth. Penis without distal hook. Accessory sac of ♀ bursa without a saccule (fig. 2, *h*).  $R_3$ - $IR_3$  and  $R_{4+5}$ -MA subparallel (except near margin). Inferior appendages ♂ not bifid . . . . . *Ecchlorolestes* nov.
- A. Clasper with distinct lobe distally on inner margin. Anteclypeus pale cream. No spot on metanotum . . . . . *peringueyi* Ris.
  - B. Clasper without distal lobe, merely thickened. Anteclypeus metallic green. A blue spot on metanotum . . . . . *nylephtha* n.sp.

*Chlorolestes conspicua* Selys.

1839. Burmeister, Handb. Entom., vol. ii, p. 823 (*longicaudum* part).
1862. Selys, Bull. Ac. Roy. Belg., ser. 2, vol. xiv, p. 34.
1921. Ris, *loc. cit.*, p. 280, fig. 15; and pl. vii, figs. 1, 2.
1921. Barnard in Ris, *loc. cit.*, p. 445, fig. (oviposition and nymph).

*Imago*.—Ac at about level of 1st Anq (slightly proximal, at, or slightly distal). Origin of A' at level of proximal side of Q (misprinted "9" in Ris).  $R_{4+5}$  at subnodus;  $IR_3$  1 cell distal. Pterostigma covering 3 (or 4) cells. At level of pterostigma 3 rows of cells in area  $IR_2$ - $R_3$ , 3 rows in  $R_3$ - $IR_3$ , these 2 veins diverging; 2 rows in  $IR_3$ - $R_{4+5}$ , usually only 1 row from middle of pterostigma, but the double row sometimes continued almost to margin; 2 rows in  $R_{4+5}$ -MA beginning at level of origin of  $IR_2$ , usually changing to 3 rows near margin, these 2 veins evenly diverging. In MA- $Cu_2$  there is a single row of cells, but sometimes an incomplete double row, or in ♀ up to 12 double rows.

*Genitalia* ♂.—Posterior hamules with antero-distal corners rectangular. Penis with short, strongly curved hook distally, which apically narrows rather abruptly to an acute point. Claspers without either basal teeth, or lobes on inner margin. Inferior appendages with the chitinised portions forming single claw-like processes.

*Abdomen* (excl. claspers).—♂ 47-51, ♀ 41-49 mm. Hind-wing, ♂ 32-33, ♀ 33-37 mm.



Labrum and occiput pale yellowish or ochreous, the upper portion of latter metallic blue-green, often blackish in ♀. Genae and bases of mandibles yellow. Anteclypeus pale ochreous, postclypeus dark brown. Labrum black. Frons and vertex metallic blue-green, darker and duller or often blackish brown in ♀; the vertex separated from upper metallic portion of occiput by an ochreous or brown interocular band. Prothorax metallic green (dark) in ♂, duller and dark brown in ♀, with a deep yellow round spot on each side. Mesepisternum metallic peacock-green, often darker and more bronzy in ♀, with a chrome-yellow stripe near (but wholly dorsal to) the humeral suture, extending  $\frac{3}{4}$ — $\frac{4}{5}$  length of mesepisternum. Mesepimeron metallic green except the antero-ventral portion. Metepisternum chrome-yellow, not extending quite to the 2nd lateral suture, along which is a metallic green stripe, more extensive and often brown in ♀. Lower portion of metepimeron and metasterna pale yellowish or whitish, with white pruinosity in ♂. Abdomen as described by Ris, but bright metallic green in ♂, duller and more bronzy in ♀; segment 1 laterally, segments 9 and 10 dorsally with pale bluish white pruinosity in ♂. Wings hyaline. Pterostigma russet in ♂, paler ochreous in ♀.

*Nymph*.—To the description already given, may be added: 1st joint of antenna slender,  $\frac{1}{2}$ — $\frac{2}{3}$  length of 2nd, 5 flagellar joints; margin of median lobe of mask finely setulose laterally, becoming spinulose medianly, inner margin of lateral lobe very feebly and inconspicuously crenulate; lateral abdominal keels ending in short acute points on the 6th (5th–7th)–9th segments; teeth on the major folds of gizzard all of the same size, alternating 3, 4, 3, 4, etc.

Brownish, somewhat mottled, especially the gills, which usually have a dark transverse band.

*Oviposition*.—The puncturing of twigs on trees overhanging streams has been recorded (Barnard, *loc. cit.*, p. 445). The name of the tree, however, should be *Cunonia*. On Table Mt. the females have been observed ovipositing in the stems of rushes (*Elegia juncea*). While ovipositing the female is not held by the male, who may not even be in attendance. On one occasion a female was seen to interrupt egg-laying in order to pair with a male; the act lasted about two minutes, when the sexes separated, and the female continued egg-laying.

The position of the female is shown diagrammatically in fig. 7, *a*; the wings are held horizontally at right angles to the body, and the abdomen forms a double right-angled bend at the 4th segment.

*Habits.*—This species inhabits wooded and open ravines in the S.W. Cape mountains, where it is common and widely distributed.

On Table Mt. the imagos start emerging about the end of November or beginning of December, and they can be found on the wing throughout the summer up to the end of April. One or two can occasionally be found in the first week in May, but by the middle of this month they have all disappeared. One specimen was seen on 21st August 1933 and was apparently freshly emerged.

They settle on bushes and rushes, never far from the stream.

The nymphs live openly on the bottom of streams or crawling about on rocks or submerged vegetation. They are very carnivorous; a full-grown one has been observed to seize a tadpole almost as long as itself and hold on to it until its struggles ceased.

Before emergence the nymph crawls up, by preference, rocks projecting out of the water.

*Localities.*—Has been observed over the whole area in question, as far north as the Cedar Mts. (Clanwilliam), and as far east as the Zwartberg Pass in the Zwartberg Range (Prince Albert), and the Robinson Pass in the Outeniqua Range. Altitude from about 500 ft. to 5000 ft., but the character of the stream is more important than actual altitude.

*Remarks.*—This is the only species which has a double row of cells between  $IR_3$  and  $R_{4+5}$  (not reckoning the 2 or 3 double cells immediately within the margin). The area  $IR_2-R_3$  is broad, and sexual dimorphism occurs in the area  $MA-Cu_2$ , where there is usually an extensive series of double cells in the ♀.

*Chlorolestes umbrata* Selys.

1862. Selys, *loc. cit.*, p. 37.

1921. Ris, *loc. cit.*, p. 283.

*Imago.*—Ac about at (or slightly proximal or slightly distal) level of 1st Anq. Origin of A' distal to proximal end of Q.  $R_{4+5}$  at subnodus,  $IR_3$  2-3 cells distal. Pterostigma covering 2-3 cells. One row of cells in area  $IR_2-R_3$ , a short series (2-3) of double or triple cells at margin; 1 row in  $R_3-IR_3$ , these 2 veins subparallel, very slightly diverging near margin where there are 2 rows of cells; 1 row in each of the areas  $IR_3-R_{4+5}$ ,  $R_{4+5}-MA$ , and  $MA-Cu_2$ , veins  $R_{4+5}$  and MA subparallel except at margin.

*Genitalia* ♂.—Posterior hamules apically narrowed. Penis with short, strongly curved distal hook, apically with acute point. Process

of sternite III shorter than in other species (fig. 9r). Claspers without either basal teeth, or lobes on inner margin. Inferior appendages with the chitinised portions forming single claw-like processes.

*Abdomen* (excluding claspers).—♂ 34–37, ♀ 31–32 mm. Hind-wing, ♂ 22–25, ♀ 21–23 mm.

Labrum black. Occiput bronzy black. Labium, genae, and bases of mandibles pale ochreous. Anteclypeus dark brown. Postclypeus, frons, and vertex metallic blue-green. Prothorax bronzy black, with a pale ochreous bar on each side. Mesepisternum bronzy greenish black, with bluish-white pruinosity in mature specimens with banded wings, with a lemon-yellow stripe which at about  $\frac{3}{4}$  the length crosses the humeral suture on to the postero-dorsal end of mesepimeron. Remainder of mesepimeron except antero-inferior corner dull bronzy green. A lemon-yellow stripe along 1st lateral suture. A dark bronzy cuneiform stripe on metepisternum. Rest of metepisternum and metepimeron pale lemon-yellow or cream, with whitish pruinosity when mature; a dark stripe on postero-inferior margin of metepimeron. Metasterna cream, with dark streak anterolaterally. Legs testaceous, dark on outer edges. Abdomen metallic bronzy or bluish green, with pale narrow bands antero-laterally on segments 3–7; segments 9 and 10, and sometimes posterior half of 8 also, with bluish white pruinosity dorsally. Wings hyaline when freshly emerged; when mature banded, whitish pruinose from nodus to 6–8 post-nodal cross-vein in fore-wing, to 5–7 in hind-wing, thence brownish to pterostigma, or to middle of pterostigma. Pterostigma russet, unicolorous. ♀ similar, but duller, the metallic portions more bronzy than green.

*Nymph*.—Resembling that of *conspicua* except in its smaller size.

*Habits*.—Occurring in the same habitats and with the same habits as *conspicua*, but apparently much more local.

*Localities*.—Table Mt., Cape Town (H. G. W. and K. H. B., March); Groot Drakenstein (K.H.B., March 1931); Kogel Berg, Hottentots Holland Mts. (K. H. B., January 1923); Palmiet River (H. G. W., January 1937); du Toit's Kloof, Rawsonville (K. H. B., March 1932, and H. G. W., March, April 1934); Wellington Mts. (H. G. W., January 1934); Waaihoek Mts., Goudini (K. H. B., March–April 1934); Buffelshoek, Hex River Mts., Worcester Distr. (K. H. B., April 1936); Knysna (R. M. Lightfoot, March 1892, 2 ♂♂); George (H. G. W., January 1936, ♂♂); Coldstream (H. G. W., January 1936, 1♂).

*Remarks.*—I have to thank Mr. D. E. Kimmins and Miss Longfield for comparing Cape specimens with the ♂ specimen in the British Museum referred to by Ris. In their opinion the specimens are certainly conspecific. The inferior appendages of the B.M. ♂ have only a single point, corresponding with Selys' description. Evidently Ris made a slip when he said (p. 284) the appendages were "of the same type as in the three following species" (i.e. *fasciata*, *tessellata*, *longicauda*), unless he intended to refer only to the superior appendages.

This is the smallest species of the genus. Apart from the non-bifid inferior appendages, it is easily separated from *fasciata* and *tessellata*, both of which develop bands on the wings, by the single row of cells in the area  $IR_2-R_3$ , and the subparallel pairs of veins  $R_3$ ,  $IR_3$  and  $R_{4+5}$ , MA, and also the position of origin of  $IR_3$ . The penis is like that of *conspicua*.

*Chlorolestes fasciata* Burm.

1839. Burmeister, Handb. Entom., vol. ii, p. 822.

1862. Selys, *loc. cit.*, p. 36.

1920. Kennedy, Ohio. Journ. Sci., vol. xxi, p. 84 (*Euchlorolestes f.*).

1921. Ris, *loc. cit.*, p. 284, fig. 17; and pl. vii, fig. 4.

*Imago.*—Ac slightly distal to 1st Anq. Origin of A' distal to proximal side of Q.  $R_{4+5}$  at subnodus,  $IR_3$  1 cell distal. Pterostigma covering 3-4 cells. Two rows of cells in area  $IR_2-R_3$ , 3 beyond pterostigma; 3 rows in  $R_3-IR_3$ , these 2 veins diverging evenly; 1 row in each of the areas  $IR_3$   $R_{4+5}$  and MA-Cu<sub>2</sub>; 2 rows in area  $R_{4+5}$ -MA at level of origin of  $IR_2$ , 3 rows distal thereto, these 2 veins diverging evenly.

*Genitalia* ♂.—Posterior hamules narrowing apically. Penis with rather long, gently curved distal hook, cultrate in shape, the dorsal edge being thin, apex spatulate or with disc-like expansion; the distal corners of the two flaps, between which the hook lies, are sharp. Claspers without either basal teeth, or lobes on inner margin. Inferior appendages with the chitinised portion forming a bifid process.

*Abdomen.*—♂ 32-38, ♀ 32 mm. Hind-wing, ♂ 25-28, ♀ 26 mm.

Labium, genae, bases of mandibles, and anteclypeus pale ochreous. Labrum, occiput, postclypeus, frons and vertex metallic blue-green. Prothorax metallic blue-green with a yellow bar on each side. Mesepisternum metallic bronzy green (duller in ♀), with a narrow yellow stripe at the humeral suture but not extending quite to

dorsal end. Mesepimeron metallic green above, yellow below, with a metallic green or dark bar on ventral margin. Metasterna yellow, with small median line at hind end. Legs ochreous, darker and somewhat metallic greenish on outer sides. Abdomen as described by Ris. Wings hyaline or banded; in the latter case whitish pruinose from Q or nodus to 5th-6th postnodal cross-veins, thence brownish to a short distance proximal from pterostigma. Pterostigma bicolorous, blackish proximally, ferruginous distally.

*Localities* (see Ris).—This species has not been found in the S.W. Cape, except the one record from "Albert Distr." (= Prince Albert.)

*Remarks*.—The metallic stripe along the upper half of the metepisternum is the most conspicuous difference separating this species from *tessellata* and *longicauda*. All three species form a closely allied group distinguished from the other species by the apex of the distal hook on the penis, the bifid inferior appendages of ♂, and the venation.

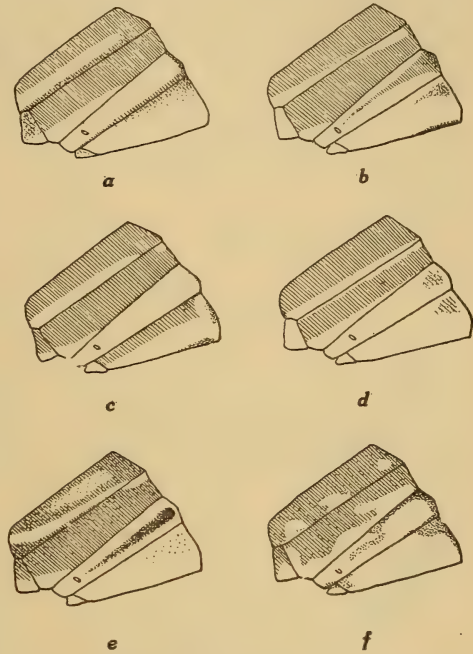


FIG. 8.—*Chlorolestes*, diagrams of thoracic patterns. a, *conspicua*. b, *umbrata*. c, *fasciata*. d, *tessellata* and *longicauda*. e, *nylephtha* n.sp. f, *peringueyi*. Cross shading represents metallic green or bronzy; dots, brown; unshaded, yellow, cream, or whitish.

*Chlorolestes tessellata* Burm.

- 1839. Burmeister, *loc. cit.*, p. 822.
- 1862. Selys, *loc. cit.*, p. 35.
- 1921. Ris, *loc. cit.*, p. 286, pl. vii, fig. 5.

*Imago*.—Venation and ♂ genitalia as in *fasciata*, except that the posterior hamules are slightly clavate, and the distal corners of the two flaps, between which the distal hook of the penis lies, are rounded.

Abdomen.—41–44 mm. Hind-wing, 29–31 mm.

Coloration as in *fasciata*, but the mesepisternal yellow stripe

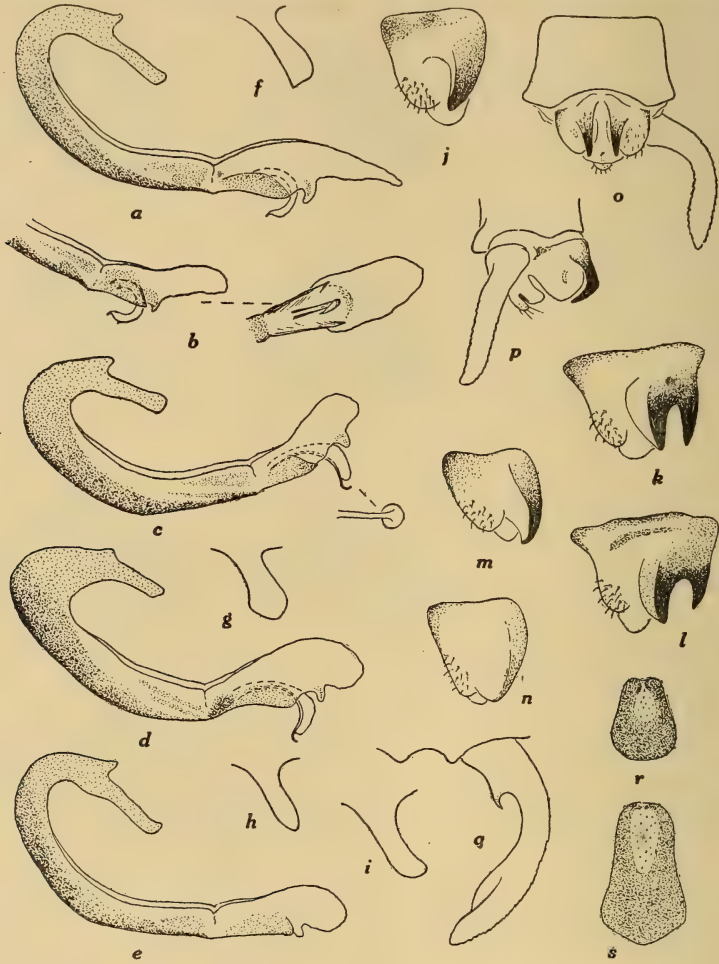


FIG. 9.—*Chlorolestes*, ♂ genitalia. *a, b, c, d, e*, penes of *conspicua*, *umbrata* (apex in lateral and ventral view), *fasciata*, *tessellata*, and *peringueyi* respectively. *f, g, h, i*, posterior hamule (anterior margin to left) of *conspicua*, *tessellata*, *peringueyi*, and *nylephtha* respectively. *j, k, l, m, n*, ventral view of inferior appendage of *conspicua*, *fasciata*, *tessellata*, *peringueyi*, and *nylephtha* respectively. *o, p*, ventral and lateral views of upper and lower appendages of *umbrata*. *q*, dorsal view of upper appendage of *nylephtha*. *r, s*, ventral view of process of 3rd sternite of *umbrata* and *tessellata* (and all other species) respectively.

broader and extending the whole length, and also below the humeral suture on to the mesepimeron; whole of the metepisternum and

metepimeron yellowish with only a faint and indefinite suffusion near the dorsal ends of these two plates.

*Localities.*—See Ris, and add, Port St. Johns, Pondoland.

*Remarks.*—I have seen one ♂ from Grahamstown, April 1892, which is not the specimen seen by Ris as the date is different. The two old specimens mentioned by Ris are no longer in the South African Museum, but there are two from Port St. Johns, named by Ris. Some specimens from the S.W. Cape may belong to this species, but as they are all unbanded they are listed under *longicauda*.

*Chlorolestes longicauda* Burm.

1839. Burmeister, *loc. cit.*, p. 823.

1862. Selys, *loc. cit.*, p. 35.

1921. Ris, *loc. cit.*, p. 287, fig. 18; and pl. vii, fig. 6.

*Imago.*—Venation, ♂ genitalia, and coloration as in *tessellata*, except that the wings apparently always remain hyaline.

*Abdomen.*—(Transvaal and Zululand specimens) ♂ 43–45, ♀ 38–45 mm. (Cape specimens) ♂ 35–39, ♀ 38 mm. Hind-wing (Transv., Zululd.) ♂ 29–34, ♀ 33–35 mm. (Cape) ♂ 27–28, ♀ 31 mm.

A pale cobalt-blue spot (often not conspicuous) between bases of hind-wings. Pterostigma in both sexes bicolorous, black (or very dark brown) proximally, cream distally (Cape specimens).

*Nymph.*—Resembling that of *conspicua*.

*Localities.*—See Ris, and add: St. Mathews, King Williams Town Distr. (R. M. Lightfoot, 1894, 1 ♀); and the following Cape localities: Keurbooms River, Plettenberg Bay (K. H. B., January 1931); Seven Weeks Poort, Ladismith (K. H. B. and H. G. W., February 1932); Robinson Pass, Outeniqua Range (K. H. B. and H. G. W., February 1932); George (H. G. W., January 1936).

*Remarks.*—Ris says this may be a geographical race or subspecies of *tessellata*. In view of the Western Province records it can scarcely be regarded as a race. The Western Province specimens are appreciably smaller than those from Zululand and the Transvaal.

*Chlorolestes peringueyi* Ris.

1921. Ris, *loc. cit.*, p. 282, fig. 16; and pl. vii, fig. 3.

*Imago.*—Ac at level of 1st Anq (or slightly proximal or slightly distal). Origin of A' at level of proximal side of Q. R<sub>4+5</sub> proximal to subnodus, IR<sub>3</sub> at subnodus. Pterostigma covering 2–2½ cells.

IR<sub>2</sub> strongly curved towards costa at level of pterostigma. Three rows of cells in area IR<sub>2</sub>-R<sub>3</sub>; 2 rows (distally) in R<sub>3</sub>-IR<sub>3</sub>, these 2 veins subparallel except at margin; 1 row in each of the areas IR<sub>3</sub>-R<sub>4+5</sub>, R<sub>4+5</sub>-MA, and MA-Cu<sub>2</sub>, veins MA and R<sub>4+5</sub> subparallel except near margin.

*Genitalia* ♂.—Posterior hamules apically narrowed. Penis without a distal hook. Claspers with basal teeth, and subterminal lobes on inner margin. Inferior appendages with the chitinised portions forming single processes.

*Abdomen*.—38-39 mm. Hind-wings, 27-29 mm.

Labium, genae, bases of mandibles, and anteclypeus pale buff or cream. Occiput black, becoming metallic greenish ventrally. Labrum, postclypeus, frons, and vertex metallic peacock-green in ♂, duller in ♀. Prothorax dull coppery or bronzy green, with 2 pale buff or cream round spots anteriorly. Mesepisternum dull metallic coppery or bronzy green, with 3 pale buff or cream spots near humeral suture, the inferior one sometimes divided into 2. Mesepimeron dull metallic coppery or bronzy with cream-coloured irregular stripe bordering 1st lateral suture. Metepisternum cream with irregular dark brown behind the spiracle, more or less confluent with a dark line along the posterior half of 1st lateral suture. Metepimeron cream with dark marks anteriorly and postero-dorsally. Metasterna pale cream or whitish with dark marks. Abdomen as described by Ris, except that "reddish brown" should be pale buff or cream (in living or fresh specimens); segments 9 and 10, sometimes also hinder half of 8, dorsally with pale bluish white pruinosity in ♂. Wings hyaline. Pterostigma dark brown in ♂, paler in ♀.

*Nymph*.—Resembling that of *conspicua*.

*Habits*.—This species inhabits open stream-beds, where the flies settle on the rocks with their wings spread out flat and closely adpressed to the surface of the rock. Their non-metallic (compared with the brilliance of e.g. *conspicua*) coloration harmonises very closely with the rocks, which, whether they be granite or sandstone, are of a more or less greyish colour. Only very rarely have the males been observed to settle on bushes; on the other hand, the females have frequently been seen in such situations, presumably with a view to oviposition, though the act in this species has not actually been observed. The resting position at night has not been observed.

*Localities*.—Ceres (R. M. Lightfoot, April 1913); Waaihoek Kloof, Goudini (K. H. B., March, April 1928); Bain's Kloof (east side) K. H. B., 1st May 1933); Jonkershoek, Stellenbosch (H. G. W.,



April 1931); Breede River near Mostertshoek (K. H. B., April 1933); du Toits Kloof, Rawsonville (H. G. W. and C. W. T., April 1934); Zanddrift and Buffelshoek Kloofs, Hex River Mts., Worcester Distr. (K. H. B., April 1930 and April 1936).

*Remarks.*—In common with *umbrata* and *nylephtha* this species has the 2 pairs of veins  $R_3$ - $IR_3$ , and  $R_{4+5}$ -MA subparallel. The strong curve of  $IR_2$  distally is characteristic. Also the thoracic colour scheme is quite different from that of the other species.

*Chlorolestes nylephtha* n.sp.

*Imago.*—Ac slightly distal to level of 1st Anq. Origin of A' distal to level of proximal side of Q.  $R_{4+5}$  proximal to subnodus,  $IR_3$  at subnodus. Pterostigma covering 2-3 cells.  $IR_2$  evenly curved. Two rows of cells in area  $IR_2$ - $R_3$ ; 1 row in area  $R_3$ - $IR_3$ , these 2 veins subparallel except at margin; 1 row in each of the areas  $IR_3$ - $R_{4+5}$ ,  $R_{4+5}$ -MA, and MA-Cu<sub>2</sub>, veins  $R_{4+5}$  and MA subparallel except at margin.

*Genitalia* ♂.—Posterior hamules slightly angular at postero-inferior corners. Penis without distal hook, as in *peringueyi*. Claspers with basal teeth, but no lobes on inner margin, merely a subterminal thickening. Inferior appendages with feebly chitinised portions along inner margins, apices not bifid.

*Abdomen.*—♂ 47-48, ♀ 40-41 mm. Hind-wing, ♂ 27-30, ♀ 29 mm.

Labium, genae, and bases of mandibles cream or pale buff. Occiput black, becoming slightly metallic greenish ventrally. Labrum, anteclypeus, postclypeus, frons, and vertex nitidulous, in ♂ very bright metallic green, in ♀ very dark brown or black. Prothorax dark brown, slightly lighter at posterior corners. Thoracic dorsum dull brown, with a slight metallic green sheen, with a lighter ochreous shade in middle or anteriorly or posteriorly, mid-dorsal line blackish, a pale yellow stripe bordering the humeral suture, at anterior end curving slightly medio-dorsally, at the posterior end descending slightly ventral to the suture. Mesepimeron similar to the mesepisternum, with the antero-ventral corner pale yellow. Metepisternum pale yellow, with a blackish cuneiform stripe in ventral half from posterior end to the spiracle. Metepimeron, metinfraepisternum, and metasterna pale yellowish white, with whitish pruinosity in ♂. In ♂ a bright cobalt-blue metanotal spot between bases of hind-wings; sometimes a similar but less conspicuous mesonotal spot between bases of fore-wings. Abdomen

dark bronzy brown dorsally, paler ventrally, with paler rings on anterior margin of each segment, dorsum of segments 1 and 2 in ♂ more or less metallic green; segments 9 and 10 dorsally with bluish white pruinosity in ♂. Wings hyaline. Pterostigma dark brown.

*Nymph*.—Resembling that of *conspicua*.

*Habits*.—At George this species inhabits the densely wooded ravines on the southern slopes of the Outeniqua Range. The flight is difficult to follow, but when resting on the bushes, the metallic green head and the blue-spot between the wings in the males are conspicuous. The Kaaiman's Gat locality is near the sea, and the flies were seen flying in the open between the forest and the river. Lemoenshoek is the most westerly locality yet discovered.

*Localities*.—George (K. H. B., January 1931); Kaaiman's Gat, near George (H. G. W. April 1933); Robinson Pass, Outeniqua Range (K. H. B. and H. G. W., February 1932); Lemoenshoek, Langeberg Range (near Heidelberg, Cape) (K. H. B., November 1927).

*Remarks*.—Agrees with *peringueyi* in the origin of  $R_{4+5}$  proximal to subnodus, basal teeth on claspers, absence of distal hook on penis, and the subparallel veins  $R_3-IR_3$  and  $R_{4+5}-MA$ . The thoracic pattern, however, conforms with that of the other species. The nitidulous and very brilliant "face," and the blue metanotal spot in ♂ are distinctive. Named after the Fair Queen in Rider Haggard's "Alan Quatermain."

#### FAM. AGRIONIDAE.

1917. Tillyard, *loc. cit.*, p. 277.

1921. Ris, *loc. cit.*, pp. 266, 288.

1933. Fraser, *loc. cit.*, p. 18 (*Coenagriidae* part).

*Imago*.—Pterostigma small, covering 1 cell or less (rarely more). No intercalary veins. Quadrilateral rectangular or oblique. Superior appendages ♂ not forcipate.

*Nymph*.—Slender. Caudal gills lamellate, simple, subnodate, or nodate, or triquetral (more or less). Gizzard with 8-16 folds, dentition variable.

#### Subfam. PLATYCNEMINAE.

1917. Tillyard, *loc. cit.*, p. 279.

1921. Ris, *loc. cit.*, p. 288.

1933. Fraser, *loc. cit.*, p. 150.

*Imago*.—Quadrilateral rectangular. 1A fully developed, reduced, or absent.

*Nymph*.—Mask with median projecting lobe, not cleft, mental and lateral setae present. Caudal gills thickened. Gizzard with 16 folds.

Gen. *Allocnemis* Selys.

*Imago*.—1A fully developed, extending several cells beyond nodus. Origin of A' at Ac.  $R_{4+5}$  at nodus,  $IR_3$  1 cell distal. Posterior



FIG. 10.—*Allocnemis leucosticta* Selys. Imago: *a*, ♂ and ♀ in act of oviposition. *b*, rootlet cut open to show 2 ova in cortex. *c*, genital valve ♀, with margin further enlarged. *d*, penis ♂. *e*, posterior hamule. *f*, *g*, lateral and dorsal views of appendages ♂. Nymph: *h*, genital valve ♀. *i*, dorsal view of caudal gills, with diagrammatic cross-sections. *j*, median gill, showing XIth tergite and suture (*s*) where gill breaks off. *k*, 3 folds of gizzard. *l*, portion of mask.

hamules well developed. Penis without a distal hook, but with the membranous apex strongly developed and bifid.

*Nymph.*—As under subfamily. Cercoids small, obtuse.

*Allocnemis leucosticta* Selys.

1921. Ris, *loc. cit.*, p. 289, fig. 19; and pl. vii, fig. 7.

*Imago.*—The bright patch on segments 8–10, and the superior appendages in ♂, are deep chrome-yellow or orange in life.

Figures of the ♂ appendages are given because Ris (fig. 19) seems to have overlooked a small strongly chitinised medio-dorsal knob between the superior appendages, and his figure does not show the ventrally projecting, somewhat bifid tooth on the superior appendages.

*Nymph.*—Up to 16–17 mm. plus gills 5–6 mm.

2nd joint of antenna twice length of 1st, 5 flagellar joints, of which the apical one is small. Mask extending back to bases of fore-legs; mentum distally projecting, margins straight, minutely crenulate and with slender conical spines, 1 mental seta on each side, lateral setae 2. Gizzard with 1–4 denticles on each of the 16 folds, which are not differentiated into major and minor folds. Gills thickened, the median one lozenge-shaped, the lateral ones triquetral in cross-section, in lateral view ovate, sublanceolate; pedicels (remnants of XIth segment) ring-like, small; gills moderately caducous.

*Oviposition.*—The position of the sexes in oviposition may be seen from fig. 10, *a*. So far as observed the ♀ is always accompanied by the ♂ (*cf.* Kennedy, 1915, Proc. U.S. Nat. Mus., vol. xlix, p. 287, fig. 54, *Argia emma*). The eggs are laid in the cortical layer of the exposed roots of *Cunonia* trees, either at the surface meniscus or below the surface of the water, nearly to the full extent of the ♀ abdomen. No doubt other trees and plants are pierced to receive the eggs, but in all observations the *Cunonia* was chosen.

*Habits.*—The species is widely distributed in the mountains of the S.W. Cape, preferring the wooded and shady ravines rather than more open ones. It has not been observed on the Cape Peninsula. Before emergence the nymphs crawl up rocks by preference. The imagos are found from October to March.

*Localities.*—All over the S.W. Cape (except the Cape Peninsula), as far north as the southern Cedar Mts., Citrusdal, and as far east as Seven Weeks Poort in the Zwartberg Range, Ladismith, George in

the Outeniqua Range, and Keurbooms River, Plettenberg Bay. Probably extends throughout the coastal belt to the Eastern Province and Natal. See Ris, and add, King Williams Town (R. M. Lightfoot, 1894).

Subfam. PROTONEURINAE.

1917. Tillyard, *loc. cit.*, p. 279.

1933. Fraser, *loc. cit.*, p. 209.

*Imago*.—Quadrilateral rectangular. 1A reduced to a short vein descending to the wing margin, or absent altogether.



FIG. 11.—*Elattonneura mutata* (Selys). *a*, penis ♂, with sculpturing on flange of groove further enlarged. *b*, posterior hamule. *c*, dorsal view of the posterior; and *d*, front view of the anterior, prothoracic processes of ♀.

*Nymph*.—Mask without setae (Tillyard, but see below). Gills constricted, saccoid, or lamellar. Gizzard with 16 folds.

Gen. *Elattonneura* Cowley.

1921. Ris, *loc. cit.*, pp. 266, 293, 439 (*Disparoneura*).

1933. Fraser, *loc. cit.*, p. 228 (*Disparoneura*).

1935. Cowley, Ent. Monthly Mag., vol. lxxi, p. 14.

*Imago*.—1A absent; A' stopping at cross-vein, which continues the distal end of quadrilateral, its origin slightly proximal to Ac. IR<sub>3</sub> at subnodus, R<sub>4+5</sub> 1 cell proximal. Two pairs of styli-form processes on posterior lobe of prothorax in ♀, the anterior pair up-standing, the hinder pair more or less horizontal, projecting back-wards. Posterior hamules well developed. Penis with distal hook strongly developed.

*Nymph*.—One mental setae on each side; lateral setae 3. Gizzard with 8 major and 8 minor folds. Gills simple, lamellar, lanceolate, secondary tracheae oblique to main axis. Cercoids very short.

*Elattoneura mutata* (Selys).

1896. Calvert, Proc. U.S. Nat. Mus., vol. xviii (1895), p. 141, fig. 15.

1921. Ris, *loc. cit.*, p. 293, fig. 21; and pl. vii, fig. 9.

1936. Cowley, Ann. Mag. Nat. Hist. (10), vol. xvii, p. 518.

*Imago*.—Gentalia ♂. Appendages as in Ris (fig. 21), *i.e.* with 2 downwardly projecting teeth on each superior appendage. A small subtriangular strongly chitinised plate between the superior appendages as in *frenulata*. Penis as in fig. 11, *a*, spinules on the basal membranous portion closely and evenly set without definite arrangement; apical claw-like process not scabrous. ♀ genital valve as figured for *frenulata* (fig. 12, *d*). Styliiform processes on prothorax ♀ as described by Ris, and here figured (fig. 11, *c, d*).

*Locality*.—Kogman's Kloof, Montagu (K. H. B. and H. G. W., January 1935); Bot River (K. H. B., January 1937).

*Elattoneura frenulata* (Hagen, Selys).

1860. Hagen in Selys, Bull. Ac. Roy. Belge, 2nd ser., vol. x, p. 17.

1921. Ris, *loc. cit.*, p. 439.

1936. Cowley, *loc. cit.*, p. 518.

*Imago*.—Venation as in *mutata*; A' curving towards anal margin, but joining the cross-vein, which continues the distal side of Q, either near or at its junction with margin of wing. R<sub>3</sub> and IR<sub>2</sub> at 5th–6th and 8th–10th postnodal cross-veins in fore-wing, at 4th and 7th–9th in hind-wing, usually at 5th and 9th, and 4th and 8th respectively.

*Genitalia* ♂.—Superior appendages with only a single downwardly projecting tooth. Penis as in fig. 12, *a*, the spinules on the membranous portion arranged in short arcs giving an imbricate (fish-scale) appearance, teeth of the distal claw-like process minutely scabrous on their hind surfaces.

Styliiform processes on prothorax ♀ as in fig. 12, *e, f*, the hinder pair less horizontal than in *mutata*, more at an angle of 45° with the front pair.

*Abdomen*.—Very dark, almost black. In ♂ an indication of a pruinose band between frons and ocelli, and on abdominal segments 8–10, but no definitely pruinose specimens observed. Thorax very dark bronzy green to middle of metepisternum (just above the metastigma), a dark suffusion along the 2nd lateral suture, the suture itself narrowly black; rest of sides and the ventral surface dirty

white or pale grey. Abdomen blackish, with scarcely any differential colouring except more brownish ventrally. Pterostigma light brown. Legs blackish, inner surfaces of femora lighter. ♀ almost as dark as ♂; a faint indication of a dark brown stripe just above the humeral suture, and a short ochreous streak midway just below; the dark

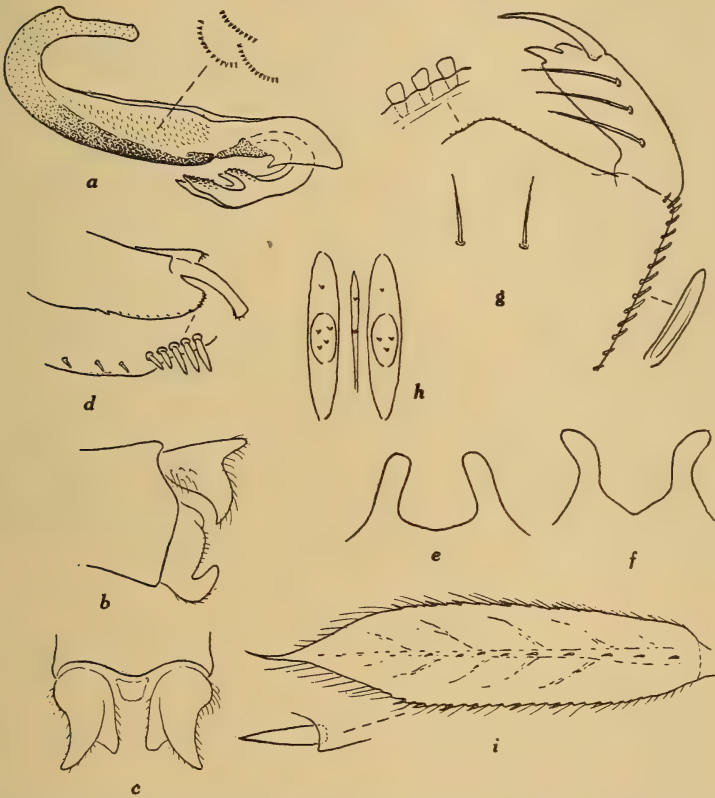


FIG. 12.—*Elatoneura frenulata* (Hagen, Selys). Imago: *a*, penis, with sculpturing on flange further enlarged. *b*, *c*, lateral and dorsal views of appendages ♂. *d*, genital valve ♀, with margin further enlarged. *e*, dorsal view of the posterior; and *f*, front view of the anterior, prothoracic processes of ♀. Nymph: *g*, portion of mask. *h*, portion of gizzard. *i*, lateral gill, with marginal spine further enlarged.

bronzy green not extending on to the metepisternum, which nevertheless has a more or less extensive smoky suffusion.

*Nymph*.—Up to 10–11 mm. plus gills 4·5–5 mm. Antenna, 1st joint short, 2nd more slender and not quite twice as long as 1st, 3rd slightly longer than 2nd, 4th subequal to 2nd, 5th, 6th, and 7th

decreasing in length, but 7th not minute. Mask extending back to between bases of fore and mid legs; median lobe not very prominent, margin straight, minutely crenulate, with blunt more or less incisiform spinules; 1 medial and 3 lateral setae; lateral margin with numerous, rather long, apically blunt spines. Gills elongate, lanceolate, with rather tapering apex, and strong marginal spines. Gizzard with 3-4 denticles in middle of each major fold, and 1 anteriorly, 1-2 denticles on each minor fold. Brownish, living amongst submerged stems of Palmiet, ferns, or other vegetation.

*Localities.*—Orange Kloof, Table Mt., Cape Town (K. H. B. and H. G. W., January); Palmiet River, near Kleinmond (H. G. W., December 1933; K. H. B. and H. G. W., December 1934; H. G. W., January 1937); N. of Tradouw Peak, Langeberg Range, near Barrydale (K. H. B., January 1935); George (H. G. W., January 1936); Hex River, Worcester (L. Peringuey, 1 ♂, 1883; 1 ♂, January 1888).

*Remarks.*—Probably no reliance can be placed on the coloration for distinguishing this species from *mutata*. The two species are easily separated, however, by the superior appendages of the ♂, and the prothoracic stylets in the ♀; the penis is an additional character.

At my request Dr. Banks kindly examined the type in the Museum of Comparative Zoology, Harvard, and sent a drawing of the ♂ appendages. There is no doubt that the present specimens are *frenulata*, a species which Dr. Banks thinks should be attributed to Hagen, who drew up the description, rather than to Selys.

#### Subfam. AGRIONINAE.

1917. Tillyard, *loc. cit.*, p. 279.

1933. Fraser, *loc. cit.*, p. 272 (*Coenagriinae*).

*Imago.*—Quadrilateral oblique, anal distal angle acute. 1A normal.

*Nymph.*—Mask with projecting median lobe, not incised, mental and lateral setae present. Caudal gills usually slender, lamellate, nodate, subnodate, or simple; secondary tracheae oblique to gill-axis. Gizzard with 8-16 folds.

#### Gen. *Pseudagrion* Selys.

1921. Ris, *loc. cit.*, pp. 266, 297.

1933. Fraser, *loc. cit.*, p. 274.

1936. Ris (and Schmidt), Abh. Senckenb. Nat. Ges., 433, pp. 1-68.

*Imago.*—Origin of A' at Ac, or slightly proximal (not more than length of Ac). No transverse ridge at frons. Superior appendages



of ♂ mostly bifurcate; penis with apical hook well developed, variously bilobed; posterior hamules small, conical, setose. No vulvar spine at 8th sternite in ♀. Most females with 2 small stylets

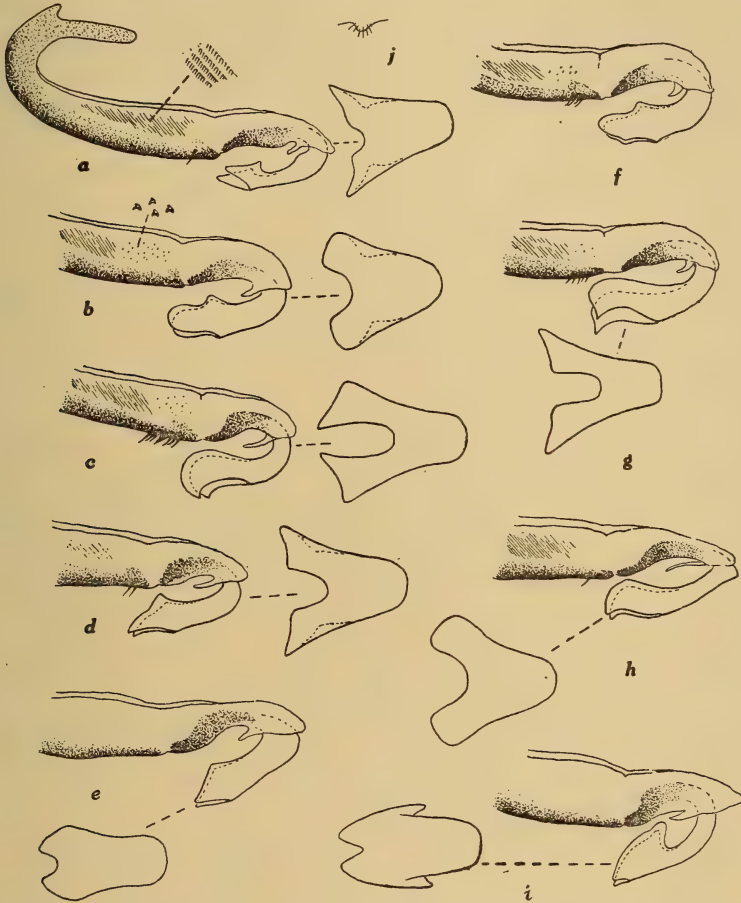


FIG. 13.—*Pseudagrion*, penes, with ventral views of apical lobe flattened out. a, *kersteni*; and b, var. *draconis*. c, *caffrum*. d, *citricola* n.sp. e, *acaciae*. f, *natalense*. g, *angolense*. h, *salisburyense*. i, *massaicum*. j, posterior hamule.

(a and e-i from specimens identified by Ris.)

at hind border of prothorax. Colour scheme mostly blue and black, most species with pale postocular spots.

*Nymph*.—Median lobe of mask rather strongly projecting; 1 mental and 3 lateral setae on each side. Gills nodate, elongate. Gizzard with 8 major and 8 minor folds. Cercoids small.

*Remarks.*—For the sake of comparison figures of the penis of all species represented in the South African Museum collections are given, taken from specimens identified by Ris. It is much to be regretted that Ris himself did not consider this feature in his 1936 revision (published posthumously, with editorial notes by Schmidt), a work which does not greatly advance the study of the genus so far as concerns the South African species. The name *praetextatum* is definitely dropped in favour of *kersteni* Gerst.

*Key to species found in the S.W. Cape.*

♂♂	{	A. Superior appendages bifid.	
		1. Superior appendages with basal inner tooth.	
		a. 7th abdominal segment dorsally black . . . . .	<i>caffrum</i> .
		b. 7th abdominal segment dorsally blue . . . . .	<i>citricola</i> .
		2. Superior appendages without basal inner tooth	
			<i>kersteni</i> and var. <i>draconis</i> .
		B. Superior appendages entire . . . . .	<i>massaicum</i> var. <i>cogmani</i> .
♀♀	{	1. Stylets on prothorax rather long.	
		a. 8th abdominal segment almost entirely blue . . . . .	<i>citricola</i> .
		b. 8th abdominal segment blue only on posterior half	
			<i>kersteni</i> and var. <i>draconis</i> .
		2. Stylets short, acute. 8th abdominal segment entirely blue, and a blue spot on hind margin of 7th segment . . . . .	<i>caffrum</i> .
		3. Stylets obsolete. 8th abdominal segment bronzy black	
		<i>massaicum</i> var. <i>cogmani</i> .	

*Pseudagrion caffrum* (Burm.).

1908. Ris in Schultze's Reise, i, pp. 315, 316 (♀ from Table Mt. *kersteni* non Gerst.).

1921. *Id.*, loc. cit., p. 300, fig. 22 (*furcigerum*).

1921. *Id.*, loc. cit., p. 301, fig. 23.

1936. *Id.*, loc. cit., p. 16, fig. 3; and p. 17, fig. 4 (*furcigerum*).

*Imago.*—Superior appendages showing gradations between the two forms represented in Ris's figs. 22 and 23, the inner basal tooth either blunt, rounded, or acute. Penis with apical hook very large, in repose the rounded apical lobes embracing the stem, which has a series of 8–10 spines on each side near the ventral margin, and often another one higher up. Prothoracic stylets of ♀ short, acute.

*Abdomen.*—♂ 25–30, ♀ 25–26 mm. Hind-wing, ♂ 19–22, ♀ 20–23 mm.

♂. Occiput pale greenish yellow. Labium, labrum, anteclypeus and lower half of eye grass green, the labrum with 1–3 black dots

or a black line at its base. Postclypeus black. Frons and dorsal surface of head bronzy blue-black in teneral, blackish in old examples, with light bluish pruinosity especially on frons. Postocular spots visible in teneral specimens, but in old specimens masked by pruinosity. Prothorax and thorax as described by Ris for *caffrum*; a black line in dorsal third of 2nd lateral suture; in old specimens a bluish pruinose antehumeral band occupying half the space between mod-dorsal keel and humeral suture, not quite touching latter. Abdomen as in Ris; on segments 8 and 9 a medio-dorsal blue band, sometimes narrow, sometimes broad, but completely concealed in old specimens by bluish pruinosity which extends over whole dorsal and lateral surfaces of segments 8-10. Superior appendages black externally, the points of the fork and the inner basal tooth black. Pterostigma reddish brown or russet (pale brown if teneral).

♀ as in Ris. Frons and postocular spots raw-sienna, darkening with age. Short black lines on dorsal third of 1st and 2nd lateral sutures. A dorsal patch on posterior half of 7th (more or less extensive), on whole of 8th, 9th, and 10th segments bright blue, but concealed under pruinosity in aged specimens. Pterostigma pale brown. In very teneral specimens the head, prothorax, and thorax are predominantly orange-brown.

*Nymph.*—Up to 16-18 mm. plus gills 7 mm. 1st and 2nd joints of antenna subequal, or 2nd slightly longer; 4 flagellar joints, with a minute apical 5th. Mask extending back to midway between bases of fore and middle legs; median lobe prominent, with slightly concave margins, set with short conical spinules; 1 mental and 3 lateral setae; outer margin of lateral lobes with blunt spinules. Gills elongate, narrow, nodate, apices shortly acute. Gizzard with 3-4 large denticles in middle of each major fold, with 3-5 in line anteriorly to these, minor folds with 2 fairly large denticles in line and 2-3 in line anterior to them. Greenish, or brownish when fully mature; living amongst weeds (*Scirpus*, etc.).

*Localities.*—Cape Peninsula (various localities from sea-level to top of Table Mt., November-March); widely distributed over S.W. Cape as far north as the Cedar Mts., Clanwilliam (K. H. B., January 1930), and as far east as Meiring's Poort, Zwartberg Range (north of Oudtshoorn) (K. H. B. and H. G. W., February 1932 and January 1935), October-March.

*Remarks.*—This species is common on Table Mt. and throughout the S.W. Cape mountains and lowlands. It seems extraordinary that the S.A. Museum had no specimens to send to Ris. There is no

doubt as to the identity of the species, and from the series at hand I do not hesitate to place *furcigerum* in synonymy. The ♀ described by Ris in 1908, and assigned to *kersteni*, should be assigned to the present species.

*Pseudagrion citricola* n.sp.

*Imago*.—Superior appendages ♂ closely resembling those of *salisburyense* Ris. Penis nearest to that of *kersteni*, but with the differences shown in fig. 13, *a, d*. Prothoracic stylets ♀ as in *kersteni*. Origin of A' slightly proximal to Ac.

*Abdomen*.—♂ 26–27, ♀ 27–28 mm. Hind-wing, ♂ 20, ♀ 20–21 mm.

♂. Occiput, labium, labrum, and anteclypeus pale buff. Postclypeus, frons, and vertex bronzy black. Postocular spots small, circular, dull bluish. Prothorax black, with bluish pruinose patches dorsally and laterally. Thorax dorsally bronzy black, pruinose, extending to the 2nd lateral suture, or slightly beyond at the dorsal end, and enclosing a narrow pale stripe on the metepisternum. Metepimeron and ventral surface pale buff, with whitish pruinosity. Abdomen dorsally metallic steel-blue black, ventrally whitish; three-quarters of dorsal surface of segment 7, and whole dorsal surface of 8 and 9 blue, more or less concealed in pruinosity. Superior appendages black at tips. Pterostigma russet-brown. Legs pale grey or buff internally, black externally.

♀. Teneral: Occiput and labium pale buff. Labrum, anteclypeus, frons, the oval postocular spots and bar connecting them orange-brown; postclypeus and an interocular band embracing the ocelli black. Prothorax black, with orange marks dorsally, orange laterally, stylets orange. Thorax orange-brown, including a narrow medio-dorsal line; a black band immediately next to the medio-dorsal line, and another from the humeral suture occupying half the width of mesepimeron. Abdomen bronzy green dorsally, buff ventrally; dorsal patches on segments 8 and 9, and whole of 10 pale. Pterostigma pale brown. Legs buff, femora and tibiae with narrow black lines externally. Intermediate stage: Darker with the orange portions on head and thorax olivaceous. Sides of thorax greyish. Abdomen bronzy black dorsally. Dark form: Almost as in ♂. Labrum and anteclypeus orange-olivaceous. The postocular spots small, round, and disconnected. Prothorax, including stylets, thorax, and abdomen black dorsally; the latter somewhat bronzy distally, and the pale patches more or less pruinose. Pterostigma pale brown. Black stripes on legs narrower than in ♂.

*Locality*.—Kridouw Krans, Olifants River, between Citrusdal and Clanwilliam (K. H. B., September 1931).

*Remarks*.—The ♂ closely resembles *salisburyense*, and the ♀ resembles *kersteni*. The pale patches on abdomen in both sexes separate this species from the other two.

*P. salisburyense* has recently been found at Aiais on Gt. Fish River, South West Africa (A. J. H. and C. W. T., November 1936).

*Pseudagrion kersteni* (Gerst.).

1921. Ris, *loc. cit.*, p. 303, fig. 25 (*praetextatum* Selys).

1936. *Id.*, *loc. cit.*, p. 18, figs. 2, a, 5 (synonymy).

*Imago*.—To supplement Ris's description, and for comparison with the two preceding species, figures of the abdominal markings in ♂ and ♀, and of the penis, are here given, taken from specimens identified by Ris.

*Localities*.—Cold Bokkeveld, N. of Ceres (M. Versfeld, October 1934, 2 ♂♂, 3 ♀♀. Bosch Kloof, Clanwilliam (K. H. B. and C. W. T., September 1936, 2 ♂♂). Seven Weeks Poort, Ladismith, Cape (K. H. B. and H. G. W., January 1935, 1 ♂).

*Remarks*.—This species appears to be very local in the S.W. Cape.

*Pseudagrion kersteni* var. *draconis* n.

*Imago*.—Superior appendages ♂ resembling those of *kersteni* in having no internal basal tooth. Penis differing from that of *kersteni* as shown in fig. 13, a, b, viz. no spines on lower margin of stem, but with minute denticles on the membranous portion, and the apical lobe with wider excision. Prothoracic stylets ♀ as in *kersteni*.

Origin of A' slightly proximal to Ac.

*Abdomen*.—♂ 28, ♀ 27 mm. Hind-wing, ♂ 19–21, ♀ 21 mm.

♂. Head black (bronzy black), postocular spots obsolete in fully mature, a band of bluish-white pruinosity between the eyes. In teneral specimens occiput, labium, labrum, ante- and post-clypeus, frons and postocular spots buff or brown, the postclypeus with dark band at base, vertex dark bronzy green. Prothorax bronzy black, with bluish pruinosity; in teneral bronzy green above with 2 buff spots. Thorax bronzy black above, shading on lower part of sides to pale greyish, with bluish pruinosity; in teneral bronzy green dorsally and upper half of mesepimeron, antehumeral stripe and

sides buff. Abdomen dorsally bronzy black with bluish pruinosity, ventrally whitish; in teneral metallic steel-blue; segments 8 and 9

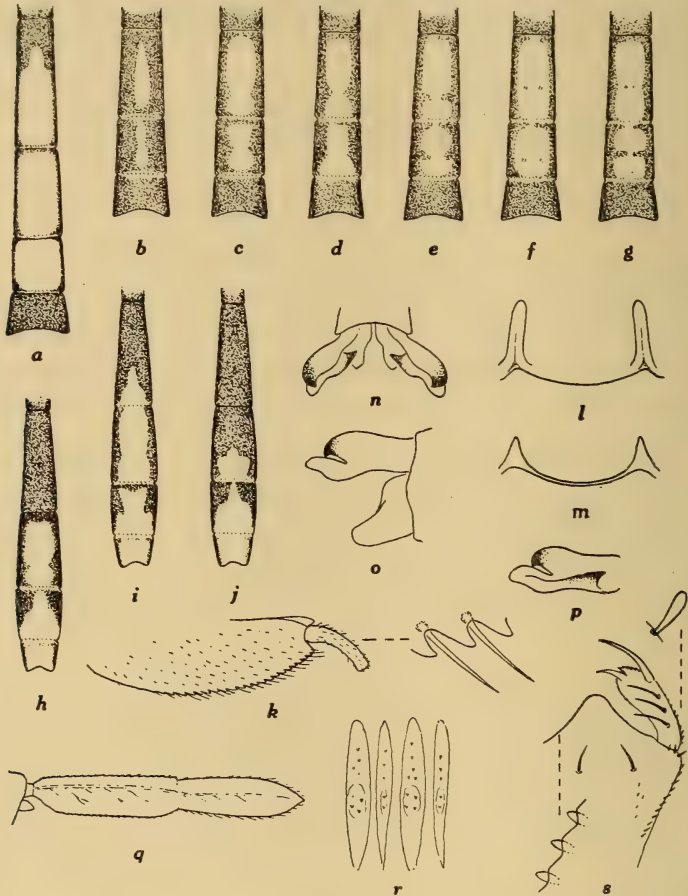


FIG. 14.—*Pseudagrion*. Imago: *a*, 7th–10th abdominal segments of ♂ *citricola* n.sp. *b–e*, 8th–10th segments ♂ of four varieties of *caffrum* (Hottentots Holland Mts., Cedar Mts., Table Mt., and Seven Weeks Poort respectively). *f*, the same, *kersteni*; and *g*, var. *draconis*. *h*, 7th–10th segments, ♀ *citricola* n.sp. *i*, the same, *caffrum*. *j*, the same, *kersteni*. *k*, genital valve ♀ *caffrum* with margin further enlarged. *l, m*, prothoracic stylets ♀ *kersteni* and *caffrum* respectively. *n, o, p*, dorsal and external lateral views of appendages ♂ *citricola* n.sp., and inner lateral view of upper appendage. Nymph of *caffrum*: *q*, median gill, with cercoid. *r*, 2 major and 2 minor folds of gizzard. *s*, portion of mask, with margin of median lobe further enlarged.

dorsally blue, more or less concealed in pruinosity (Gt. Drakenstein); in the Montagu specimen the blue colour extends half-way down the sides of the segments, so that in dorsal view the whole surface

appears blue, or there is a small transversely oval blue patch on segment 10. Apices of superior appendages blackish. Pterostigma dark brown in mature, paler in teneral specimens. Legs blackish and more or less pruinose in mature, buff with thin dark lines on the femora in teneral.

♀. Teneral (but *in copula*): Occiput, face, and postocular spots buff, vertex bronzy green. Prothorax ochreous. Thorax ochreous, with bronzy green stripe on either side of mid-dorsal keel, and a similar stripe on mesepimeron bordering the humeral suture. Abdomen bronzy green above, buff below, buff-coloured dorsal patches on segments 8 and 9 as in *kersteni*, 10 wholly buff. Legs buff with narrow black lines on outer surface of femora. Pterostigma pale brown. Thorax and abdomen becoming bluish in adult, segment 10 blue.

*Localities*.—Groot Drakenstein (K. H. B., March 1931, 1 ♂).

Kogman's Kloof, Montagu (K. H. B., January 1935, ♂♂, ♀♀; A. J. Hesse and C. W. Thorne, November 1935, ♂♂, ♀♀). Bot River (K. H. B., January 1937, ♂♂).

*Pseudagrion massaicum* Sjöstedt.

1921. Ris, *loc. cit.*, p. 310, fig. 29.

1936. *Id.*, *loc. cit.*, p. 50, fig. 26.

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 473.

var. *cogmani* n.

*Imago*.—Ac nearly equidistant from 1st and 2nd Anq, slightly nearer the former. Origin of A' proximal to Ac by slightly less than length of Ac. Post-nodal cross-veins 12 in fore-wing, 10 in hind-wing. R<sub>3</sub> and IR<sub>3</sub> respectively at the 6th and 8th post-nodal cross-veins in fore-wing, at 5th and 9th in hind-wing. No cross-vein between A' and anal margin until opposite lower distal angle of Q. Apices of wings not much rounded. Pterostigma longer than deep in both wings. Hind margin of prothorax evenly convex; stylets in ♀ obsolete. No mesepisternal tubercle. Tarsal claws with inferior tooth. Superior appendages ♂ equal to mid-dorsal length of Xth segment, which is not elevated, but widely excised, with 4-5 digitiform spines on hind margin on either side of median line. Each appendage entire (not bilobed), appearing to end in an incurved acute point owing to feeble chitinisation of inner distal surface. Inferior appendages broadly lobate, obscurely bilobed. Penis

without lateral spines on stem, apical hook elongate, with 2 short proximal and 2 elongate distal lobes, and short lateral alate projections. Posterior hamules obsolete.

*Abdomen*.—♂ 27, ♀ 26–27 mm. Hind-wing, ♂ 18, ♀ 19–20 mm.

♂. Occiput and labium yellow ochre, the former blackish around foramen and the postocular band. Labrum, clypeus, frons, vertex, and postocular spots (which are connected) coppery red. Eyes scarlet. Prothorax blackish with 3 coppery spots. Thorax dorsally coppery red, shading on sides into greenish, and then ventrally into

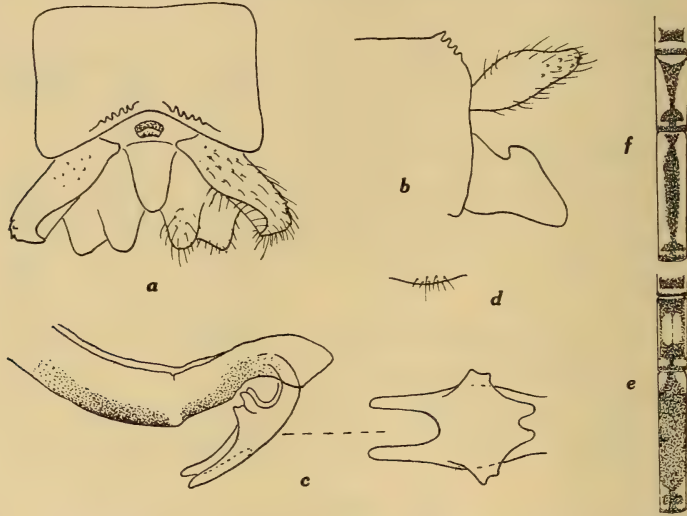


FIG. 15.—*Pseudagrion massaicum* Sjost. var. *cogmani* n. a, b, dorsal and lateral views of ♂ appendages. c, apex of penis, with dorsal view of apical lobe. d, posterior hamule. e, f, diagrams of pattern on abdominal segments 1–3, ♂ and ♀ respectively.

cobalt-blue. A bronzy black medio-dorsal stripe, a similar stripe on humeral suture with a semicircular expansion on medial side near dorsal end, and dark marks at postero-dorsal ends of 1st and 2nd lateral sutures. Femora black, tibiae and tarsi ochreous, former with black line externally, latter with black junctions between the joints. Abdomen with segments 1–7 bronzy green, dorsal pattern on segments 1–3 (see fig. 15, e), segments 8, 9, and 10 deep cobalt-blue. Superior appendages blackish. Pterostigma russet.

♀. Occiput and face buff. Vertex and postocular spots brownish, the latter outlined with black. Eyes grey with darker bands. Prothorax ochreous brown, with black marks. Thorax bronzy brown, paler and pruinose below, black markings as in ♂. Legs as



in ♂, but ground colour paler. Abdomen with segments 1-9 bronzy green above, pale greenish below, dorsal pattern on segments 1-3 (see fig. 15, f), segment 10 cobalt-blue, segment 1 often pruinose. Pterostigma russet.

*Locality.*—Kogman's Kloof, Montagu (K. H. B., January 1935, 1 ♂; A. J. Hesse and C. W. Thorne, November 1935, ♂♂, ♀♀).

*Remarks.*—This form is exceedingly close to the Zululand specimens identified by Ris as *massaicum*, but differs in the quite distinctive penis in ♂, and the slightly stronger dorsal pattern on abdominal segments 1-3 in ♀. It may eventually be raised to specific rank.

The male of this damselfly is most striking in flight, as its head and thorax, appearing like burnished copper, make a wonderful contrast with the bright blue of the end of the abdomen.

Gen. *Ceriagrion* Selys.

1921. Ris, *loc. cit.*, pp. 267, 314.

1933. Fraser, *loc. cit.*, p. 313.

*Imago.*—Origin of A' at Ac or slightly proximal. A transverse ridge on frons. Superior appendages ♂ not bifurcate. No vulvar spine on 8th sternite ♀. No prothoracic stylets ♀. Colour scheme mostly orange or reddish, no postocular spots.

*Ceriagrion glabrum* (Burm.).

1921. Ris, *loc. cit.*, p. 314, fig. 31.

*Imago.*—Posterior hamules well developed (cf. *Elattonneura*, fig. 11, b). Penis with apical lobe broadly expanded and shortly notched at apex, 3-4 short adpressed spinules on each side of stem.

*Localities.*—Knysna (R. M. Lightfoot, April 1890; and H. G. W., January 1936). Keurbooms River, Plettenberg Bay (K. H. B., January 1931). Drakenstein (A. C. H. and K. H. B., February 1937).

*Remarks.*—The nymph of this damselfly is unknown.



FIG. 16.—*Ceriagrion glabrum* (Burm.). Penis, with ventral view of apical lobe. The heavily chitinised portion of stem is only faintly dotted so as to show the adpressed spinules.

Gen. *Enallagma* Charpentier.1908. Ris, *loc. cit.*, p. 310.

1920. Kennedy, Ohio Journ. Sci., vol. xxi, p. 87.

1921. Ris, *loc. cit.*, pp. 267, 317.1933. Fraser, *loc. cit.*, p. 371.

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 474.

*Imago*.—Origin of A' proximal to Ac by more than length of Ac. Arculus at 2nd Anq (or only slightly distal). R<sub>3</sub> usually at 5th

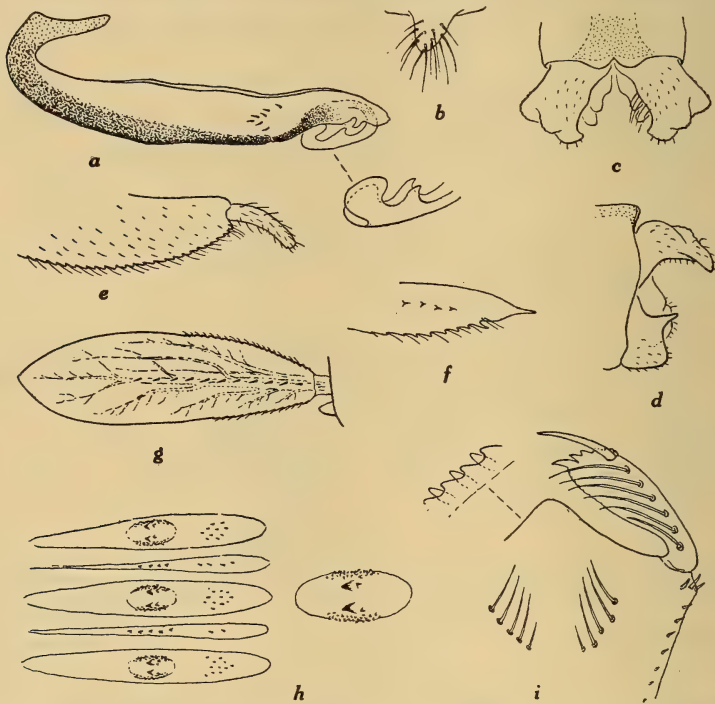


FIG. 17.—*Enallagma glaucum* (Burm.). Imago: *a*, penis, with apical lobe further enlarged. *b*, posterior hamule. *c*, *d*, dorsal and lateral views of appendages ♂ (in *c* the upper appendages are more spread out than in Ris's 1921 figure). *e*, genital valve ♀. Nymph: *f*, genital valve ♀. *g*, median gill with cercoid. *h*, portion of gizzard, with one of the chitinous plates further enlarged. *i*, portion of mask with margin of median lobe further enlarged.

(or 6th) postnodal cross-vein in fore-wing, at 4th (or 5th) in hind-wing. Xth segment ♂ not, or only slightly, elevated at posterior margin. ♀ with vulvar spine on 8th sternite. Pterostigma in ♂ unicolorous in both wings. Posterior hamules rather small, conical, setulose. Penis with bilobed apical hook.

*Nymph.*—Median lobe of mask rather strongly projecting, 4 mental and 6 lateral setae. Gills subnodate or simple, sometimes slightly thickened. Cercoids small. Gizzard with 8 major and 8 minor folds.

*Remarks.*—Kennedy (*loc. cit.*, 1920, p. 87) has proposed for *E. glaucum* and *subfurcatum* the respective generic names *Africallagma* and *Proischnura*. *Africallagma* is based on the Xth segment of ♂ elevated into a dorsal keel, notched at apex. It includes also *nigridorsum* Selys, *obliteratum* Selys, and *schultzei* Ris. *Proischnura* has the Xth segment ♂ apically forked, the pterostigma of hind-wings smaller than that of fore-wings, and penis intermediate between those of *Ischnura* and *Enallagma*. I have no material by which to test the value of these characters; and, moreover, it seems that Kennedy's division does not coincide with that of Ris. See also Miss Longfield's remarks. So far as concerns the South African fauna the subdivision of *Enallagma* has no practical value.

Of the species mentioned in Ris (1921), I have examined the penis of *nigridorsum*, *pseudelongatum*, and *sinuatum* in addition to that of *glaucum*. In *pseudelongatum* and *sinuatum* the penis is very similar to that of *glaucum*, and scarcely of specific importance. That of *nigridorsum*, however, has the apical lobes of the distal hook quadrangular instead of rounded, and sufficiently distinct to serve as a differential character.

*Enallagma glaucum* (Burm.).

1908. Ris, *loc. cit.*, p. 313, fig. 3.

1921. *Id.*, *loc. cit.*, pp. 318, 326, fig. 38.

*Imago.*—Figures of the ♂ appendages are given here, viewed in a slightly different position from those figured by Ris.

*Nymph.*—Up to 11–12 mm. plus gills 5 mm. Antenna with 2nd joint half as long again as 1st (or nearly so), 3rd subequal to 1st and 2nd together. Mask extending back to between bases of fore and middle legs; median lobe with anterior margins slightly concave, minutely serrulate and with short conical spinules; often a 5th mental seta on one side or on both sides, smaller than the usual 4. Gills slightly obovate, lamellate, thin, spinules on the median gill extending farther along the dorsal than along the ventral margin, *vice versa* in the lateral gills. Gizzard with denticles arranged as in fig. 17, *h*. Pale greenish or brownish, sometimes slightly variegated.

*Oviposition.*—Females, held by the males, have been observed ovipositing just beneath the surface in stems of reeds (*Juncus*)

(Table Mt., K. H. B.). They were also observed crawling down 3 or 4, or even 6 inches below the surface in order to oviposit, but unaccompanied by the males (Muizenberg Reservoir, A. C. H. and K. H. B.). The eggs are laid singly in rows.



FIG. 18.—*Enallagma polychromaticum* n.sp. Imago: *a*, *b*, dorsal and lateral views of appendages ♂. *c*, ventral view of inferior appendage. *d*, apex of penis, with apical lobe further enlarged, and in ventral view. Nymph: *e*, *f*, median and lateral gills, with cross-sections, and cercoid.

*Localities*.—Widely distributed in the S.W. Cape from the Cape Peninsula to the Kamiesberg, Namaqualand, in the north (K. H. B., September 1931), and eastwards to Knysna (R. M. Lightfoot, 1890), Murraysburg (C. W. T., 1931), Vogelfontein, Prince Albert Div. (A. J. H., 1930), and Grahamstown (Miss Walton). May, September, November to April; probably all the year round in many localities.

*Enallagma polychromaticum* n.sp.

*Imago*.—Ac equidistant from 1st and 2nd Anq. Origin of A' proximal to Ac by slightly more than length of Ac. A cross-vein between A' and anal margin at level of upper distal angle of quadrilateral. Postnodal cross-veins 10 in fore-wing, 8 in hind-wing. R<sub>3</sub> and IR<sub>2</sub> respectively at the 5th and 7th (sometimes 4th and 6th) postnodal cross-veins in fore-wing, at 4th and 6th (or 7th) in hind-wing. Apices of wings rounded, almost as much as in *rotundipenne*; pterostigma longer than deep, less so in hind-wing. Hind margin of prothorax evenly convex, with small medio-dorsal rounded tubercle. A small rounded tubercle on anterior margin of mesepisternum midway between medio-dorsal keel and humeral suture. Tarsal claws with inferior tooth.

Superior appendages ♂ half length of Xth segment, which is not elevated and has a small notch between 2 small rounded lobes on hind margin (smaller than the similar notch in *glaucum*), dorsally a chitinised point, which, however, scarcely projects above the surface (fig. 18). Inferior appendages with blunt, incurved, and slightly upturned apices. Penis without the lateral spinules found in *glaucum*; apical hook with the projections narrow and acute, the inner surfaces minutely scabrous. ♀ with vulvar spine on 8th segment; genital valve as in *glaucum*. Abdomen: ♂ 17-71.5, ♀ 18 mm. Hind-wing, ♂ 12-12.5, ♀ 12.5 mm.

♂. Occiput pale buff, blackish around foramen. Labium pale buff. Labrum mauve with 3 black dots at its base. Postclypeus mauve with black basal transverse bar. Frons mauve. Vertex dark bronzy green. Postocular spots cuneiform, violet, narrowly connected. Prothorax dark bronzy green with 3 mauve dots (1 median and 1 on each lateral margin), sometimes 2 dots in place of each single dot. Thorax bronzy green, without a medio-dorsal pale line (in fully adult), with a violet antehumeral stripe nearly as wide as the dark median band, but not extending quite to humeral suture; the latter occupied by a bronzy-green stripe as wide as the violet antehumeral stripe. Rest of mesepimeron, whole of metepisternum, and a cuneiform patch at dorsal end of metepimeron violet. Rest of metepimeron, mesinfraepisternum, sterna, and coxae pale buff but shading up into the violet. Pterostigma dark sepia. Femora wholly black in fully mature on inner and outer surfaces. Tibiae with black lines on outer surface. Abdomen with segments 1-7 bronzy green above, pale buff below; a narrow pale ring anteriorly on segments 3-7, and the dorsal colour extending slightly down the sides at the posterior margins of segments 2-6. Segments 8 and 9 each with a shield-like bright violet (fully adult) or deep cobalt-blue patch dorsally, surrounded by bronzy green. Segment 10 bronzy green dorsally and laterally. Segments 8-10 ventrally pale buff. Superior appendages blackish, inferior appendages with black chitinised apices. The mauve and violet colour fades after death to buff or greyish.

♀ similar but with the following differences; all mauve or violet patches are here buff or pale greyish, a narrow pale medio-dorsal line on thorax, femora with blackish lines on outer surfaces only, a small oval cobalt-blue patch dorsally on 9th abdominal segment, pterostigma pale sepia brown.

*Nymph.*—Up to 9-10 mm., plus gills 3-4 mm.

In general similar to that of *glaucum*. Mask with 4 mental and 6 lateral setae. ♀ genital valve as in *glaucum* but the teeth rather stronger. Gizzard with fewer denticles on the folds. Gills lanceolate, with pointed apices, slightly thickened (see cross-sections, fig. 18), the margins more strongly spinulose, and the distal portions with rather long setae.

*Locality*.—Seven Weeks Poort, Zwartberg Range, Ladismith, Cape (K. H. B. and H. G. W., February 1932 and January 1935. ♂♂, ♀♀ and nymphs).

*Remarks*.—This is the smallest dragon-fly yet found in the Western Province, and, barring the tropical *Agriocnemis exilis*, the smallest in the South African fauna.

#### Gen. *Ischnura* Charpentier.

1917. Kennedy, Proc. U.S. Nat. Mus., vol. lii, p. 496 (penis).

1921. Ris, *loc. cit.*, pp. 267, 333.

1933. Fraser, *loc. cit.*, p. 346.

*Imago*.—Origin of A' proximal to Ac by more than length of Ac. Arculus at 2nd Anq (or only very slightly distal). R<sub>3</sub> usually at 4th postnodal cross-vein in fore-wing, at 3rd in hind-wing. Xth segment ♂ elevated at posterior margin. ♀ with vulvar spine on 8th sternite. Posterior hamules fairly prominent, stout, setose. Penis with long bifurcate apical hook. Pterostigma in ♂ bicolorous in fore-wing.

*Nymph*.—Median lobe of mask rather strongly projecting; 4 mental and 6 lateral setae. Gills simple (or subnodate), lanceolate, thin. Gizzard with 8 major and 8 minor folds. Cercoids small and inconspicuous.

#### *Ischnura senegalensis* (Rambur).

1908. Ris, *loc. cit.*, p. 310.

1921. *Id.*, *loc. cit.*, p. 333, fig. 42.

1928. Andrés, Mem. Roy. Entom. Soc. Egypt, vol. iii, p. 25, pl. iii, figs. 5, 6 (coloured).

1933. Fraser, *loc. cit.*, p. 348, figs. 150, 151.

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 471.

*Imago*.—Coloration as given by Ris. Abdominal segments "5-7" should read 3-7. The blue colour on segments 1 and 2, and especially on segments 8, 9, and 10 is very brilliant sky or cobalt blue. The distal half of pterostigma in fore-wing ♂ is blue in life.

*Nymph*.—Up to 17–18 mm. plus gills 6–6.5 mm.

Antenna with 2nd joint not quite twice length of 1st, 3rd slightly longer than 2nd. Mask extending back to between bases of fore and middle legs; median lobe with straight anterior margins, crenulate and with short, bluntly conical spinules. Gills lanceolate with acute apices; spinules on median gill extending farther along

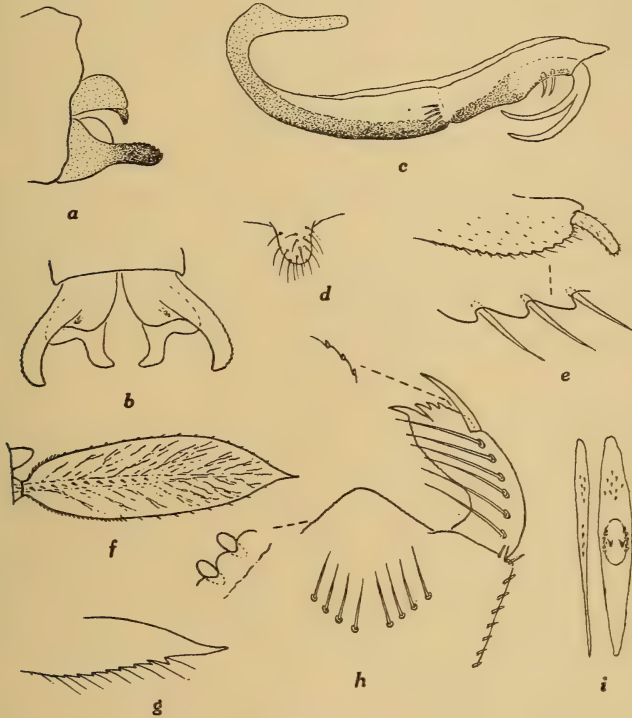


FIG. 19.—*Ischnura senegalensis* (Rambur). Imago: *a*, *b*, lateral and ventral views of appendages ♂. *c*, penis. *d*, posterior hamule. *e*, genital valve ♀, with margin further enlarged. Nymph: *f*, lateral gill with cercoid. *g*, genital valve ♀. *h*, portion of mask with margins of median and lateral lobes further enlarged. *i*, major and minor folds of gizzard.

dorsal margin than along ventral, *vice versa* in lateral gills. Gizzard with denticles on the folds as in *E. glaucum*.

Pale greenish or yellowish, more or less variegated. Living amongst weeds.

*Oviposition*.—The ♀, unaccompanied by the ♂, rests on weeds floating on the surface, and bends the abdomen forwards to deposit eggs in the vegetation just under the surface (*cf.* Kennedy, Proc.

U.S. Nat. Mus., vol. xlix, p. 302, fig. 88, 1915). The eggs are laid singly in rows.

*Localities.*—Widely distributed over the S.W. Cape, but more of a lowland than a mountain form, from Olifants River, Clanwilliam (A. J. H., 1932), in the north, to Keurbooms River, Plettenberg Bay (K. H. B., 1931), in the east. Also Aiais on Gt. Fish River, South West Africa (A. J. H. and C. W. T., November 1936).

*Remarks.*—This species is very abundant at Lakeside in the Cape Peninsula, where the water is at times slightly brackish.

#### FAM. AESCHNIDAE.

1917. Tillyard, *loc. cit.*, p. 259.

1921. Ris, *loc. cit.*, p. 338.

1934. Fraser, Fauna Ind. Odonata, vol. ii, p. 154 (*Gomphidae*).

*Imago.*—Triangles of fore- and hind-wings similar or nearly so. Lateral lobes of labium of about the same size as median lobe. Antenodal cross-veins in costal and subcostal areas not corresponding.

*Nymph.*—Mask flat (in South African forms).

#### Subfam. GOMPHINAE.

1917. Tillyard, *loc. cit.*, p. 260.

1921. Ris, *loc. cit.*, p. 338.

1934. Fraser, *loc. cit.*, p. 157.

1936. Schmidt. Senckenbergiana, xviii, p. 270 (nymphs, West Europe species).

*Imago.*—Eyes separated by a large space. Triangles short, costal side not much longer than proximal side, free or crossed. Inferior appendage ♂ bifid. No well-developed ovipositor. Auricles present on 2nd abdominal segment in ♂.

*Nymph.*—Legs more or less modified for digging, fore and mid tarsi 2-jointed. Antennae reduced to 4 joints, the 4th often minute. Mask not extending beyond (or only slightly) bases of fore-legs, with flat median lobe, lateral lobes with narrow rounded or uncinat apex and strong movable spine. Gizzard with 4 folds. Rectal gills simplex undulate or simplex papillate.

#### Key to S.W. Cape genera.

1. No distinct anal loop. 8th and 9th segments foliate. Superior appendages ♂ longer than 10th segment. ♀ vulvar scale short and broad. Nymph with narrow ovate abdomen, without dorsal keel . . . . *Mesogomphus*.
2. A distinct anal loop of more than 2 cells. 8th segment foliate. Superior appendages ♂ shorter than 10th segment. ♀ vulvar scale narrow and elongate. Nymph with broadly ovate abdomen, with dorsal keel . . . *Ceratogomphus*.



Gen. *Mesogomphus* Forster.

1918. Rich, S. Afr. J. Sci., vol. xiv, p. 426 (rectal gills of nymph).

1921. Ris, *loc. cit.*, pp. 340, 343.

1929. Ander, Konowia, vol. viii, p. 159 (nymph).

1934. Fraser, *loc. cit.*, p. 228.

*Imago*.—Hind femora not reaching beyond junction of thorax and abdomen. MA and Cu<sub>2</sub> in fore-wing diverging at level of nodus or more distally. Between Rs and MA in hind-wing a single cross-vein. No distinct anal loop. Superior appendages ♂ considerably longer than 10th segment. Penis in *cognatus* and *elpidius* ending in two slender divergent prongs, which in repose lie between two lateral flaps on the bulbous basal portion. In *hageni* the penis is noticeably different, ending in two short prongs which lie within the cowl-like projection of the basal portion. Vulvar scale ♀ (8th segment) short and broad. Lateral margins of 8th and 9th abdominal segments foliate.

*Nymph*.—Wing sheaths divergent. Anterior margin of median lobe of mask strongly convex, minutely denticulate, with fringe of close-set palisade-like spines, outer distal angle with 2–3 spines, and lateral margins slightly convergent, sparsely setose; apex of lateral lobe narrowly rounded or subacute, but not uncinata, inner margin not denticulate. Legs short. Third antennal joint fusiform, 4th joint distinct, upturned. Abdomen narrow-ovate, without medio-dorsal keel. Anal appendages all of same length. Gizzard with strong denticles on the 4 folds. Rectal gills papillate.

*Remarks*.—Ander described only the external features of the nymph. Rich described the rectal gills of a nymph assumed to be that of *Mesogomphus*. His paper was prior to Ris's monograph, and a misidentification seems certain because he described the rectal gills as undulate, whereas I find them to be papillate (at least in *cognatus*). It may be, however, that the character of the rectal gills does not coincide with the generic characters of the imagos, and that other species, e.g. *hageni*, do have undulate gills. Perhaps Rich's specimens were *Ceratogomphus*.

Ander says the anterior margin of median lobe of mask is not denticulate in *hageni*, but in *cognatus* I find that it is denticulate when seen under a high magnification.

*Mesogomphus hageni* (Selys).

1921. Ris, *loc. cit.*, pp. 343, 344, figs. 46-48; pl. ix, fig. 2.

1929. Brain, *loc. cit.*, p. 155.

1929. Ander, *loc. cit.*, p. 159, figs. 1-4 (nymph).

*Imago*.—Tips of superior appendages ♂ parallel, acute. Anterior hamule unciniate, posterior hamule irregularly rectangular (Ris,

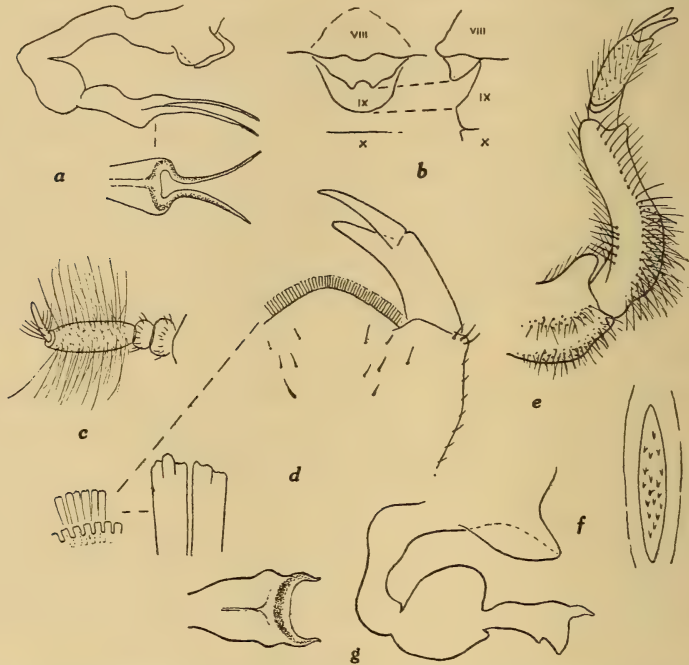


FIG. 20.—*Mesogomphus cognatus* (Rambur). Imago: *a*, penis, with ventral view of apical lobe. *b*, ventral and lateral views of 8th-10th abdominal segments ♀. Nymph: *c*, lateral view of antenna. *d*, portion of mask, with margin of median lobe and spines further enlarged. *e*, dorsal view of right fore leg. *f*, 1 of the 4 folds of the gizzard. *M. hageni* (Selys). *g*, penis in lateral view, with apex in ventral view.

fig. 47). Penis strongly bulbous subapically, the apical portion being broad, with two short, widely separated prongs, which lie within the cowl-like projection on the basal portion. Pterostigma light ochreous, greyer near margins, in ♀ between strong black veins. Costa yellowish. Face and frons without dark bands. Thoracic markings pale.

*Nymph*.—Anal appendages  $2\frac{1}{2}$  times length of 10th tergite (Ander).

*Locality*.—Nearest locality to S.W. Cape recorded by Ris, Dun-

brody. Messrs Lawrence, Hesse, and Thorne (of the S.A.M.) caught two ♂♂ near Viol's Drift on the Orange River, Namaqualand, in March 1935. Brain, however, says it occurs "as far south as Tulbagh."

*Mesogomphus cognatus* (Rambur).

1908. Ris, *loc. cit.*, p. 318 (*Onychogomphus c.*).

1921. *Id.*, *loc. cit.*, pp. 343, 347, figs. 52, 53; pl. viii, fig. 3; pl. ix, fig. 4.

1929. Brain, *loc. cit.*, p. 155.

*Imago*.—Tips of superior appendages ♂ divergent, blunt, minutely dentate. Anterior and posterior hamules uncinatae (Ris, fig. 53). Penis (see fig. 20, a); in repose the apices lie between the lateral flaps of the bulbous basal part. Pterostigma dark or blackish brown. Costa yellowish. Frons with black band at base in ♂, frons and face with black transverse lines in ♀. Thoracic markings dark.

*Nymph*.—Up to 24–26 mm., width of abdomen 6 mm. Resembling that of *hageni* (as described by Ander), but the anal appendages do not exceed twice the length of 10th segment, usually scarcely twice as long. Segments 4–9 with small lateral points. A small medio-dorsal tubercle on segments 2 and 3. Appendix dorsalis acutely pointed. Abdominal pattern as in *hageni*. Rectal gills papillate. Hind femora reaching to end of 2nd abdominal segment. All femora with prominent distal lobe. Mid and fore tibiae curved, armed on outer margin with strong setae. Claws slightly curved, apically blunt, glabrous. Pale sand-coloured, faintly mottled.

*Localities*.—Cape Peninsula; S.W. Cape as far north as Cedar Mts., Clanwilliam (K. H. B., January 1930 and September 1936), and as far east as Cango (K. H. B. and H. G. W., February 1932).

*Remarks*.—This species is very common and widely distributed. The nymphs burrow in sand and gravel in running streams, but are easily bred in captivity. They do not climb up reeds or other vegetation before emergence of the imago, but crawl on to a stone or the margin of the stream, or a projecting sand-spit in mid-stream, or floating vegetation.

Gen. *Ceratogomphus* Selys.

1921. Ris, *loc. cit.*, pp. 340, 354.

*Imago*.—Hind femora not reaching beyond junction of thorax and abdomen. MA and Cu<sub>2</sub> in fore-wing diverging at level of nodus or

more distally. Between Rs and MA hind-wing a single cross-vein. A distinct anal loop of 4 cells. Appendages of ♂ much shorter than



FIG. 21.—*Ceratogomphus pictus* Selys. Imago: *a*, *b*, lateral and dorsal views of apical abdominal segments ♂ with appendages (in *a* the right upper appendage omitted). *c*, ventral view of lower appendage. *d*, dorsal view of variation in right upper appendage. *e*, *f*, lateral and dorsal inner views of lower appendage of same specimen as *d*. *g*, 2nd abdominal segment ♂ with genitalia. *h*, ventral view of apical portion of penis. Nymph: *i*, dorsal view of nymph, with profile of abdomen. *j*, dorsal view of right antenna. *k*, portion of mask with margin of median lobe further enlarged. *l*, dorsal view of right fore leg.

10th segment. Penis (see below, and fig. 21, *h*). Vulvar scale of ♀ on 8th segment long and narrow. Xth segment in ♂ with a dorsal

acute process fitting into a groove on the 9th segment. Lateral margins of 8th segment foliate.

*Nymph*.—Wing sheaths divergent. Anterior margin of median lobe of mask convex, minutely denticulate, with palisade-like spines, and setae near hinge of lateral lobe, outer distal angle without spines, lateral margins parallel, thickly setose; apex of lateral lobe bluntly pointed, not uncinata, inner margin denticulate. Legs moderately long. Third antennal joint with straight inner margin, 4th joint minute. Abdomen broadly ovate, medio-dorsally keeled. Cercoids shorter than the other anal appendages. Gizzard with strong denticles on the 4 folds. Rectal gills undulate.

*Ceratogomphus pictus* Selys.

1908. Ris, *loc. cit.*, p. 319, fig. 7 (wings).

1921. *Id.*, *loc. cit.*, p. 355, fig. 60; pl. viii, fig. 6; pl. ix, fig. 7.

*Imago*.—As Ris had no ♂ good enough for a figure of the genitalia and appendages, figures of these are here given. Anterior hamules ovate, set transversely; posterior hamules very large, oblong, with forwardly directed tooth on antero-inferior margin. Penis with prongs of the apical fork produced in long recurved points. The bulbous basal part with a lateral flap on either side, between which the apices of the penis lie. Superior appendages strongly chitinised, outer basal margin serrate, apices curved downwards, somewhat variable in shape, dorsal surface proximally with a feebly chitinised area which is produced in a membranous digitiform process. Lower appendage subquadrangular but somewhat variable, usually with deep and well-marked apical cleft (fig. 21, *c*), but sometimes with very narrow cleft (fig. 21, *f*), dorsal surface distally with a black, strongly chitinised ridge on either side of the cleft, which ridge may develop one or two distinct pointed teeth.

*Nymph*.—Up to 27 mm., width of abdomen 9 mm. 4th antennal joint less than apical width of 3rd joint. Mask extending to between bases of fore-legs, median lobe with parallel sides. Hind femora reaching to end of 4th or middle of 5th abdominal segment. All femora with small distal lobe, and 2 glabrous stripes on dorsal surface not covered with setae or pilosity. Tibiae also with a bare stripe; the fore tibia with distal outer angle prominent. Claws setose, apically acute. Abdomen narrowing rather rapidly from 7th segment; segments 7-9 with short acute lateral points. Segments 2-9 medio-dorsally keeled; on segments 2 and 3 the keel forms small tubercles,

on the others a low backwardly directed tooth, that on segment 9 being the largest. Cerci a trifle longer than, cercoids slightly shorter than, the appendix dorsalis, which is acutely pointed. Denticles on gizzard folds as in *M. cognatus* (fig. 20, *f*). Pale brown, with a pair of darker spots on segments 5–9 dorsally.

*Localities*.—Cape Peninsula, Stellenbosch, French Hoek, Cango.

*Remarks*.—Not actually bred, but the correlation seems quite certain as this is the only other Gomphine genus besides *Mesogomphus* known from the S.W. Cape, and the nymphs came from Jonkershoek, Stellenbosch, where the adults are plentiful.

#### Subfam. AESCHNINAE.

1917. Tillyard, *loc. cit.*, p. 262.

1921. Ris, *loc. cit.*, p. 356.

1936. Fraser, Fauna Ind. Odonata, vol. iii, p. 53 (*Aeshnidae*).

*Imago*.—Eyes dorsally contiguous. Triangles longitudinally elongate, crossed. Inferior appendage ♂ not bifid. ♀ with ovipositor similar to that of the *Zygoptera*.

*Nymph*.—Abdomen elongate. Legs and antennae normal. Mask flat, without setae (except in *Gynacantha*), lateral lobes narrow, apices variable. Gizzard with 4 folds, each with one large tooth or a few large teeth. Rectal gills duplex, foliate or papillo-foliate.

#### Key to S.W. Cape genera.

1. IR<sub>3</sub> forked proximal to pterostigma, with more than 2 rows of cells between its branches. Sectors of arculus, near its middle. Anal angle of hind-wing angulated in ♂. Auricles present in ♂ . . . . . *Aeschna*.
2. IR<sub>3</sub> forked distal to middle of pterostigma, with only 2 rows of cells between its branches. Sectors of arculus, nearer to R. Anal angle of hind-wing rounded in both sexes. No auricles in ♂ . . . . . *Anax*.

#### Gen. *Aeschna* Fabricius.

1917. Tillyard, *loc. cit.*, pp. 340, 350.

1921. Ris, *loc. cit.*, pp. 358, 361.

1921. Rousseau, Larves et Nymphes Aquat., vol. i, p. 118 (nymph).

1936. Fraser, *loc. cit.*, p. 123 (original spelling: *Aeshna*, etym. doubtful).

*Imago*.—As above in key. Cells between IR<sub>3</sub> and Rspl not distinctly arranged in rows. End of R<sub>3</sub> slightly and gently convex towards costa.

*Nymph*.—Eyes hemispherical. Mask in repose not extending beyond coxae of middle legs; lateral lobe with broad, squarely truncate apex. Anal pyramid long.

*Key to species.*

1. Upper surface of frons with black spot surrounded by yellow, and then a dark margin. Lateral lobes of 2nd segment ♂ much produced. ♀ appendages long. Supra-coxal projection of nymph single . . . . . *rileyi*.
2. Upper surface of frons with black T mark. Lateral lobes of 2nd segment ♂ not strongly produced. ♀ appendages short. Supra-coxal projection of nymph bifid . . . . . *minuscula*.

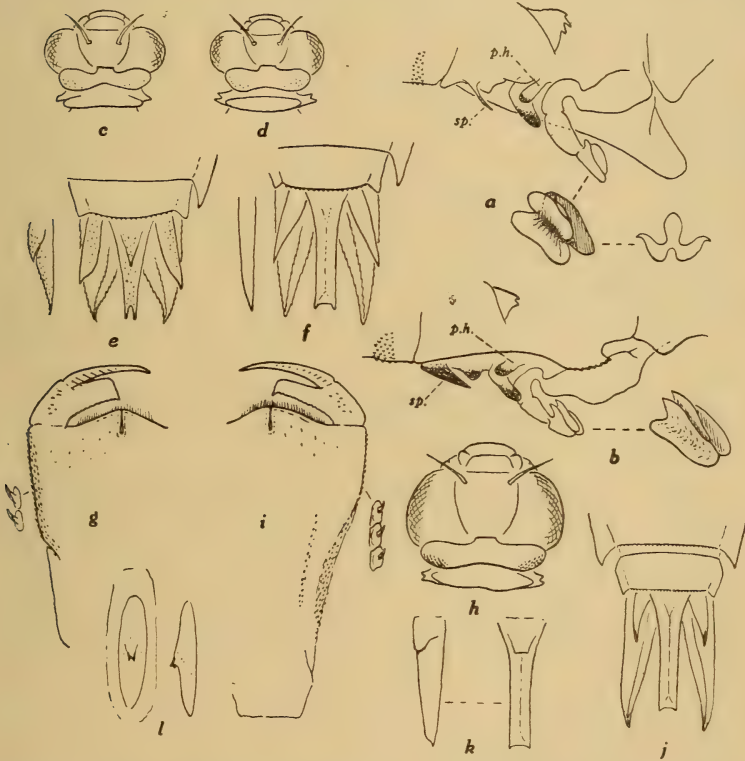


FIG. 22.—*Aeschna*. Imago: *a*, lateral view of 1st-3rd abdominal segments ♂ of *rileyi*, with apical lobe of penis viewed obliquely and in cross-section, the left lateral lobe omitted. *b*, the same segments of *minuscula*. Nymph: *c*, *d*, head and prothorax of *rileyi* and *minuscula* respectively. *e*, *f*, anal pyramid of *rileyi* ♂ and *minuscula* ♀ respectively, with appendix dorsalis in lateral view. *g*, portion of mask.

*Anax imperator mauricianus*. Nymph: *h*, head and prothorax. *i*, portion of mask. *j*, anal pyramid ♀. *k*, lateral and dorsal views of appendix dorsalis ♂. *l*, one of the folds of the gizzard, with lateral view of tooth.

(*p.h.* posterior hamule. *sp.* spinous process.)

*Aeschna rileyi* Calvert.

1892. Calvert, Trans. Amer. Entom. Soc., vol. xix, p. 164.

1921. Ris, *loc. cit.*, p. 361, fig. 63, and pl. viii, fig. 8 (*subpupillata*).

1929. Brain, *loc. cit.*, p. 158 (*subpupillata*).

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 480 (discussion).

*Imago*.—Characters as in key. Anal triangle of hind-wing ♂ 3-celled (*cf.* Tillyard, *loc. cit.*, 1917, fig. 171, B). Auricles with 3 denticles. Lateral lobes of 2nd segment ♂ strongly produced posteriorly, lobes of 3rd segment also produced anteriorly. Anterior spinous process (fig. 22, *a*) slender, chitinised only at apex. A narrow transverse band of spinules on 1st sternite. Penis (fig. 22, *a*).

*Nymph*.—Up to 38 mm. Supra-coxal projection single. Anal pyramid equal to 9th plus 10th segments. Cerci broad with all margins strongly serrate. Appendix dorsalis narrowing to a narrowly cleft apex. Whole surface of abdomen and anal pyramid strongly granulate. Lateral margins of 6th to 9th segments produced in spines.

*Localities*.—Widely distributed over the S.W. area, but not yet actually caught in the Cape Peninsula.

*Aeschna minuscula* MacLach.

1895. MacLachlan, Ann. Mag. Nat. Hist. (6), vol. xvii, p. 421.

1921. Ris, *loc. cit.*, pp. 361, 364, fig. 64.

1929. Brain, *loc. cit.*, p. 158.

*Imago*.—Characters as in key. Anal triangle of hind-wing ♂ 3-celled. Auricles with 2 denticles. Lateral lobes of 2nd segment ♂ slightly produced, margin serrate; lobes of 3rd segment also slightly produced. Anterior spinous process (fig. 22, *b*) strong, chitinised throughout. A broad transverse band of spinules on 1st sternite. Penis (fig. 22, *b*). Superior appendages ♂ slightly narrower than in *rileyi*.

*Nymph*.—Up to 40 mm. Supra-coxal projection bifid. Anal pyramid slightly longer than 9th plus 10th segments. Cerci slender with margins feebly serrate. Cercoids more slender than in *rileyi*, tapering evenly. Appendix dorsalis with subparallel margins, apex with wide but shallow notch. Surface of abdomen and anal pyramid less strongly granulate than in *rileyi*. Lateral margins of 7th–9th segments produced in spines.

*Localities*.—Widely distributed in the S.W. area, including the Cape Peninsula.



Gen. *Anax* Leach.

- 1917. Tillyard, *loc. cit.*, pp. 341, 350.
- 1921. Ris, *loc. cit.*, pp. 358, 367.
- 1921. Rousseau, *loc. cit.*, p. 122 (nymph).
- 1936. Fraser, *loc. cit.*, p. 134.

*Imago*.—As above in key. Cells between IR<sub>3</sub> and Rspl arranged in distinct rows. End of R<sub>3</sub> abruptly bent towards costa opposite distal end of pterostigma.

*Nymph*.—Eyes very large, flattened dorsally. Mask in repose extending back to coxae of hind legs; lateral lobe with apex narrowed and with incurved tooth. Anal pyramid very long.

*Key to species.*

- 1. Bright red . . . . . *speratus*.
- 2. Blue or green . . . . . *imperator mauricianus*.

*Anax speratus* Hagen.

- 1921. Ris, *loc. cit.*, p. 368.

This unmistakable dragon-fly has been observed at the reservoirs, Kalk Bay (Cape Peninsula); Palmiet River, River Zonder End Mts.; Wellington Mts.; and George. Its nymph is as yet unknown.

*Anax imperator* Leach.

Form *mauricianus* Rambur.

- 1908. Ris, *loc. cit.*, p. 320, figs. 9–11.
- 1921. Ris, *loc. cit.*, p. 368; pl. xii, fig. 4 (nymph).
- 1936. Longfield, *loc. cit.*, p. 482.

*Nymph*.—Up to 55 mm. Supra-coxal projection bidentate but not prominent. Abdominal segments and anal pyramid smooth, only finely and sparsely granulate. Lateral margins of 7th–9th segments produced in spines. Appendix dorsalis almost as long as cerci, parallel-sided, apex with wide and shallow notch. Mask (fig. 22, *i*). The tooth on each fold of the gizzard is apically bidentate and surrounded by a few very minute denticles. Greenish or brownish, more or less mottled.

*Localities*.—Widely distributed over the S.W. area, including the Cape Peninsula.

*Remarks*.—Tillyard (*loc. cit.*, p. 351, footnote) has pointed out Ris's slip in regard to the length of the appendix dorsalis. This mistake has been copied by Rousseau (*loc. cit.*, p. 122).

## FAM. LIBELLULIDAE.

1917. Tillyard, *loc. cit.*, p. 265.

1921. Ris, *loc. cit.*, pp. 338, 374.

1936. Fraser, *Fauna Ind. Odonata*, vol. iii, p. 156.

*Imago*.—Triangles of fore- and hind-wings dissimilar, that of former transverse and far removed from arculus, that of latter longitudinal and close to or under arculus. Lateral lobes of labium very large and overlapping the small median lobe. Antenodal cross-veins in costal and subcostal areas coinciding, one or more of the distal ones sometimes incomplete. ♀ with vulvar scale. Inferior appendage ♂ not bifid.

*Nymph*.—Antennae 7-jointed. Mask spoon-like, with wide lateral lobes. Gizzard with 4 folds, each fold with 1-2 strong teeth, the 2 dorsal ones farther forward than the 2 ventral ones, thus bilaterally symmetrical.\*

## Subfam. CORDULINAE.

1917. Tillyard, *loc. cit.*, p. 265.

1921. Ris, *loc. cit.*, pp. 338, 374.

1936. Fraser, *loc. cit.*, p. 158.

*Imago*.—Triangle of fore-wing not much narrowed. Anal border of hind-wing angulated in ♂. Auricles present in ♂. Tibial keel present in ♂ (on all legs or only on fore-legs).

*Nymph*.—Lateral lobes of mask with deep or moderately deep indentations. Rectal gills duplex, lamellate, usually purplish in colour.

*Key to genera of S.W. Cape.*

1. Anal loop of hind-wing short, rounded, 3 cells in width. Triangle of hind-wing distal to arculus . . . . . *Macromia*.
2. Anal loop of hind-wing rather long, not more than 2 cells in width. Triangle of hind-wing very slightly distal to arculus . . . . . *Presba*.

Gen. *Macromia* Rambur.

1921. Ris, *loc. cit.*, p. 375.

1936. Fraser, *loc. cit.*, p. 161.

*Imago*.—Characters as in key. Tibial keel present on all legs ♂. Sectors of arculus with a common stalk.

\* Tillyard (p. 107) says "there are four folds, two on one side lying considerably more anteriorly than the other two." If this were so, the gizzard could not be described as bilaterally symmetrical; the true orientation is as above.

*Nymph*.—Legs long. A conical horn-like process on front of head between the antennae.



FIG. 23.—Nymph provisionally assigned to *Macromia picta* Selys. *a*, head, with scale-like spines on frontal ridge further enlarged. *b*, portion of mask, with margins of median and lateral lobes further enlarged.

*Macromia picta* Selys.

1908. Ris, *loc. cit.*, p. 326, figs. 14, 15.

1921. *Id.*, *loc. cit.*, pp. 376, 377, pl. viii, fig. 10, and pl. x, fig. 1.

*Locality*.—This species has been found in the S.W. Cape area at Palmiet River, near Kleinmond (H. G. W., December 1933). There is also a specimen in the S.A. Museum from Upington.

Nymph provisionally assigned to *Macromia picta*.

Several nymphs were collected at the Palmiet River locality (mid December 1934, K. H. B. and H. G. W.), 5–13 mm. in length. They were mostly found between the decaying leaf-bases on submerged stems of the Palmiet (*Prionium*), and apparently in conformity with the habitat, were noticeably flattened. Dark brown, somewhat greenish, with a paler medio-dorsal stripe on the abdomen.

Surface finely and closely granulate, without setae or pilosity, but with a few scattered rather long setae in the smallest specimens. Antennae in length about  $1\frac{1}{2}$  times their distance apart, similar to those of *Presba venator*. Head with a projecting triangular transverse ridge just below the bases of antennae, its apex truncate and margins with flattened scale-like spines; on upper surface behind level of eyes a pair of conical tubercles, slightly wider apart than the bases

of antennae; lateral margins behind eyes strongly convergent. Eyes very prominent. Abdomen flattened, ovate, without any medio-dorsal keel or tooth-like projections, postero-lateral angles of segments 8 and 9 produced in short acute points, segment 10 short,



FIG. 24.—*Presba venator* Brnrd. Nymph: *a*, dorsal view. *b*, antenna. *c*, ventral view 8th–10th abdominal segments and anal pyramid ♂. *d*, portion of mask, with margins of lateral and median lobes further enlarged. *e*, *f*, a posterior and an anterior lamella from the rectal gills. *g*, diagram of hind part of a hemibranch of the rectal gills, showing position of tubercles on the lamellae. *h*, gizzard, opened out, showing the 2 ventral teeth on left, the 2 dorsal ones on right. *i*, lateral view of a ventral and a dorsal tooth.

much narrower than 9th, cercoids slightly shorter than appendix dorsalis, which is shorter than the cerci. Mandibles with the same arrangement of teeth as in *Helothemis* (fig. 30, *k*). Mask extending back to between bases of middle legs; median lobe with distal margins concave, a series of 11–12 spines; lateral lobes with 6 (7) lobes and 5 (6) rather deep indents, 7 lateral spines, hind margins spinose, outer margin with stout apically blunt spines. Femora and tibiae

with a few elongate slender spines on upper margin, mostly in pairs, least numerous on fore-leg, trifold and quinquefid spines on lower anterior surface of apex of fore-tibia, no other divided spines (see figs. 26, 30); upper margin of tibiae distally with strong, blunt-tipped spines, tarsi with double rows of acute spines. Gizzard as in *Presba venator* (*infra*, fig. 24). Rectal gills with 15–20 lamellae on each hemibranch, faintly mauve in colour.

Gen. *Presba* Brnrd.

1933. Barnard, *Stylops*, vol. ii, p. 167 (notation as in Ris and Tillyard, 1917).

*Imago*.—Characters as in key. Tibial keel present on all legs ♂. Sectors of arculus arising separately in both wings. In fore-wing MA and Cu<sub>2</sub> parallel, or slightly divergent distal to level of nodus.

*Nymph*.—Legs moderately long. Eyes small. No conical process or tubercles on front of head; a transverse ridge just below bases of antennae. Anal pyramid short, all the appendages of equal length. Abdominal segments without any medio-dorsal tubercles or processes.

*Key to species.*

1. Coloration in general black and red, with white marks on abdomen. Inferior appendage ♂ half length of superior appendages . . . . . *venator*.
2. Coloration black and yellow. Inferior appendage ♂  $\frac{3}{4}$  length of superior appendages . . . . . *piscator*.

*Presba venator* Brnrd.

1933. Barnard, *loc. cit.*, p. 167, fig. 1, *a-e*.

*Imago*.—As in key.

*Nymph*.—Up to 25 mm. Surface smooth, finely setose, but often appearing granulate on account of foreign particles adhering to the surface. Lateral margins of head behind eyes convergent, but each with a triangular projection. Antennae slender, length  $1\frac{1}{2}$  times distance between their bases. Abdominal segments without any medio-dorsal projections, lateral margins of segments 8 and 9 only ending in very small points. 10th segment very short, considerably narrower than 9th. Anal pyramid about equal to 9th plus 10th segments, all the appendages of the same length, or cercoids slightly shorter. Mandibles as in *Helothemis* (fig. 30, *k*), the apical teeth in full-grown nymphs very blunt (worn down). Mask in repose extend-

ing back to coxae of middle legs; median lobe with distal margins slightly concave, a series of 14–16 mental setae; lateral lobes with 7 projections and 6 moderately deep indentations, a series of 9–10 lateral setae. Fore tibia and tarsus (all 3 joints) with divided spines (see p. 240); mid and hind tibiae and tarsi with simple acute spines. Gizzard with 4 strong, almost molariform teeth. Rectal gills with about 25 lamellae on each hemibranch, each lamella with only 1

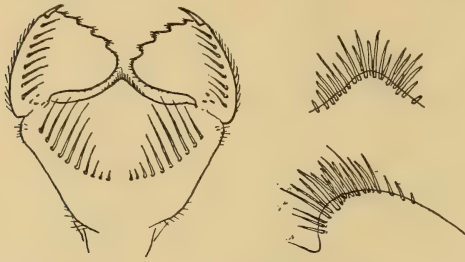


FIG. 25.—Nymph provisionally assigned to *Presba piscator* Brnrd. Mask with apex of median lobe, and margin of lateral lobe further enlarged.

anterior tubercle, except the posterior pair which have a posterior tubercle also; each lamella with scabrous apical papilla, the posterior lamellae more falcate than the anterior ones.

*Oviposition.*—The ♀ extrudes a clump of ova and then dips the end of the abdomen in the water, the eggs separating at once on touching the water. The eggs are subspherical, .5 mm. in diameter, salmon coloured.

*Localities.*—Table Mt., Cape Town (K. H. B. and H. G. W., December–February); French Hoek Mts. (K. H. B. and H. G. W., December 1932; H. G. W., October 1933); Hottentots Holland Mts. (K. H. B. and H. G. W., January 1933); Wellington Mts. (H. G. W., January 1934); Keeromberg, Worcester (K. H. B., January 1930, nymph shucks); Gt. Winterhoek Mts., Tulbagh (K. H. B. and H. G. W., November 1932, nymph shucks).

*Remarks.*—A number of nymphs was collected in Orange Kloof, Table Mt., in March 1933; from some of these, kept in a tank well supplied with mud and Entomostracan food, the flies emerged in October–November (H. G. W.); others, not so well supplied, lived until January 1934, when they were killed for anatomical purposes (K. H. B.). It may be mentioned that one of them lived for 2 hours in a solution of 95 per cent. alc. plus glacial acetic acid. The French Hoek locality was visited on 1st October 1933 (K. H. B.), when no flies were observed. On the 8th October, however, they were abundant and feeding on stone-flies, etc. (H. G. W.).

The time of emergence therefore seems to be from early in October; and the flies are on the wing until the end of February.

The nymphs live in streams, underneath stones and amongst the

mud and vegetable debris. The duration of the nymph stage appears to be about 20 months. Prior to emergence the nymphs crawl up the sides of rocks.

*Presba piscator* Brnrd.

1933. Barnard, *loc. cit.*, p. 168, figs. 1, *f-h* and 2.

No further examples of this species have been captured or observed.

Nymph provisionally assigned to *Presba piscator*.

Up to 25-26 mm. Body sparsely setose. Legs moderately long. Antennae slightly longer than distance between their bases, inserted distinctly in advance of level of anterior margin of eyes; a transverse ridge just below bases of antennae. Eyes rather small but prominent. Lateral margins of head behind eyes strongly convergent. Abdomen regularly oval, widest across segment 5. Segments 8 and 9 ending in short, acute lateral points. No medio-dorsal keel or projections. Anal pyramid slightly longer than segments 9 plus 10, cerci slightly longer than appendix dorsalis, cercoids  $\frac{2}{3}$  length of latter. Mask extending to between coxae of fore-legs; median lobe with narrowly rounded apex and concave margins, apex densely set with spines which decrease in size laterally. Lateral lobes with 5 broad projections separated by moderately deep indents. Mental setae 10, lateral setae 7-8, very stout. No divided spines on legs; stout simple spines on apices of tibiae, and in double rows on 1st and 2nd joints of tarsi, more slender spines on 3rd joint of tarsi.

*Localities.*—Ceres (K. H. B., March 1922); Bains' Kloof, Wellington Mts. (Breede River side) (K. H. B., May 1933).

*Remarks.*—Both empty shucks. The close resemblance of this nymph to that of *P. venator* suggests that it belongs to *piscator*, the only other Corduline as yet known from the S.W. districts (except *Macromia picta*, see *supra*), although there is a marked difference in the armature of the legs.

Subfam. LIBELLULINAE.

1917. Tillyard, *loc. cit.*, p. 269.

1936. Fraser, *loc. cit.*, p. 240.

1921. Ris, *loc. cit.*, pp. 338, 382.

1927. Calvert, Univ. Iowa Studies Nat. Hist., vol. xii, No. 2, pp. 15 *sqq.*)

*Imago.*—Triangle of fore-wing usually narrowed (transversely elongate). Anal border of hind-wing rounded in both sexes. Auricles absent. No tibial keel on fore-legs.

*Nymph*.—Lateral lobes of mask with very shallow (normally) indentations. Rectal gills duplex, lamellate; white, purplish or black. Legs sometimes short and robust, sometimes rather elongate and slender.

*Remarks*.—Calvert has drawn attention to certain characters of the nymphs, which may be useful for generic distinction, viz. the mandibles and the armature on the legs.

In addition to the four apical teeth in each mandible, the hindmost two of which may coalesce, there are (in some genera) 4 knob-like, strongly chitinised teeth; between these latter and the apical teeth there may be a denticle on the anterior margin and another on the posterior margin. One or more of the knob-like teeth, and the marginal teeth may be obsolete, and Calvert gives a distinctive formula for the four genera studied by him. The South African genera, whose nymphs are known, likewise show distinctive dental features; but while *Pseudomacromia* (fig. 32, *e*) is well distinguished by having only a single knob-like tooth in each mandible, the other genera (*Orthetrum*, *Crocothemis*, *Helothemis*, and *Trithemis*) are very similar (fig. 30, *k*).

As regards the armature of the legs the grouping of the genera is different. On the lower surface of the tibiae and tarsi there are numerous movable spines,\* which on the tarsi are arranged in two longitudinal rows, an anterior and a posterior row (the legs being extended at right angles to the body-axis). Some of these spines are simple and others divided into 2, 3, 4, or 5 prongs. The distribution of the divided spines on the legs seems to be of generic importance. In the South African nymphs they are present on the fore tibia and hind tarsus in *Orthetrum capense*, on the fore and mid tibiae, and all the tarsi in *Crocothemis erythraea*, *Helothemis dorsalis*, and *Trithemis arteriosa*, but are completely absent in *Pseudomacromia* (figs. 26, 30, 32).

It should be emphasised that the nymphs of other species of these genera should be examined before the above mandibular and pedal characters are incorporated in the generic diagnoses.

#### Gen. *Orthetrum* Newman.

1921. Ris, *loc. cit.*, pp. 385, 391.

1936. Fraser, *loc. cit.*, p. 291.

*Imago*.—Arculus as a rule distal to 2nd Anq. More than 10 Anq, the last one in fore-wing complete. Sectors of arculus with common

\* Calvert uses the word *seta* for a spiniform structure articulated by a ball and socket joint to the integument, and *spine* for a non-articulated spiniform projection of the integument itself. In this paper articulated structures are called spines or setae according as they are respectively robust or slender and hair-like.



stalk. Discoidal cell in fore-wing beginning with (usually) 3 rows of cells. Triangle in fore-wing with usually 1, but sometimes 2, cross-veins; proximal side of triangle in hind-wing at arculus, usually free, sometimes crossed. One Ac in hind-wing. One or 2 rows of cells between  $IR_3$  and Rspl. Lobe of prothorax large.

*Nymph*.—Body setose. Legs short, robust. Lateral margins of head behind eyes nearly parallel. Antennae inserted considerably in advance of level of anterior margin of eyes. Medio-dorsal keel on abdomen more or less developed, but no tooth-like projection on segment 8.

*Remarks*.—As Ris remarks (*loc. cit.*, p. 391), the work of Calvert and himself has brought order out of chaos among the very numerous species of this genus. The identification of South African species is fairly easy. It is therefore a thankless proceeding to upset Ris's arrangement and question some of his identifications. A study of the penis, however, in the comparatively very small collection of the South African Museum, has revealed characters which are likely to be of systematic importance. Neither Ris, nor so far as I am aware any other worker, has examined or utilised this structure.

The most important results of this study of the penis, using the specimens actually identified by Ris, are these: *farinosum* has a penis so different from those of the other species as almost to justify generic separation; the Worcester specimen of *caffrum* is quite different from those from the Transvaal and Eldoret; *guineense* and *abbotti* are very closely allied, but easily distinguished from *chryso-stigma*.

The penis of *farinosum* is described below. In all the other species included in Ris's monograph, except *trinacria* and *icteromelas*, of which there are no ♂♂ in the S.A. Museum collection, the penis has the following structure:—

The basal joint is much enlarged proximally, strongly geniculate, and has a blunt tooth on the antero-dorsal distal margin. The 2nd joint is much smaller.\* The 3rd joint is bulbous. Ventrally it bears two lobes separated by a small notch, each lobe in cross-section is L-shaped, the outer portion lying horizontal, the median portion vertical. Dorsally there is a feebly chitinised cowl-like projection, from the hollowed base of which springs a long hair-like process,

\* Tillyard (*loc. cit.*, 1917, p. 217) says that the orifice is situated on this joint. It may be noted that after treating the penes in KOH, the dissolved internal tissues could not be squeezed out through any orifice situated at the spot indicated by Tillyard (fig. 96 C or.).

strongly arched proximally, and distally armed with very minute retrorse points. The structure is completed by a pair of lateral clasper-like moderately chitinised processes, which vary in shape and hence are useful classificatory characters (fig. 26, *b-h*).

According to these lateral processes the species fall into the following groups:—

Processes slender, elongate, not bifid . . . . .	{	<i>guineese.</i> <i>abbotti.</i>
„ subanceolate, not bifid . . . . .	{	<i>caffrum</i> (from Transvaal and Eldoret). <i>rubens</i> n.sp.
„ with a tooth on lower margin, sub-bifid . . . . .	.	<i>chryso stigma.</i>
„ strongly bifid . . . . .	{	<i>stemmale</i> (Lorenzo Marques and M'fongosi). <i>brachiale.</i> <i>capense.</i>

The question of the identity of *capense* and its separation from *stemmale* is discussed below.

Calvert's suggestion (Proc. U.S. Nat. Mus., vol. xviii, p. 130, 1896) that the vulvar lamina of the ♀ might provide specific characters has not been found to hold good, except in the case of *farinosum* as opposed to the other species.

The character of the hamule of the ♂ genitalia should be used with caution, as this process may be subject to shrivelling in dried specimens, and in a KOH preparation it will probably not coincide exactly with the figures given by various authors.

### Key to the S.W. Cape species.

[Extra-Cape species in brackets.]

- I. Basal segments of abdomen not widened laterally and very little dorso-ventrally; segment 3 not constricted. Penis and vulva (see fig. 26, *a, k*).  
*farinosum.*
- II. Basal segments considerably widened, and segment 3 constricted. Penis and vulva (see fig. 26, *b, j*).
  - A. Abdominal appendages (superior appendages ♂, anal appendages or cercoids ♀) pale yellow. Penial processes bifid.
    1. Antenodal subcostal cross-veins blackish. Usually one row of cells between IR<sub>3</sub> and Rspl . . . . . [*stemmale*].
    2. Antenodal subcostal cross-veins pale or ochreous. Usually 2 rows of cells IR<sub>3</sub>-Rspl . . . . . [*brachiale*].



FIG. 26.—*Orthetrum*. Imago: *a*, penis of *farinosum* (Dunbrody). *b*, penis of *capense*, with ventral lobe in ventral view, and with one half flattened out (lateral process of right side omitted). *c*, apex of penis of *caffrum* (Transvaal and Eldoret). *d*, *e*, *f*, *g*, *h*, lateral process of penis of *brachiale* (Lorenzo Marques), *stemmate* (Zululand), *chrysostigma* (Lorenzo Marques), *guineense* (Natal), and *abbotti* (Zululand) respectively. *i*, left side of 2nd abdominal segment ♂ *capense*. *j*, *k*, 8th and 9th sternites ♀ of *capense* (and other species) and *farinosum* respectively. Nymph of *capense*: *l*, dorsal view of 8th–10th segments and anal pyramid. *m*, head. *n*, profile of abdominal segments 3–8. *o*, dorsal tooth of gizzard. *p*, portion of mask with margins of lateral and median lobes further enlarged. *q*, anterior surface of tarsus and apex of tibia of fore leg.

(*a*, *c*–*h*, *k* from specimens identified by Ris.)

B. Abdominal appendages dark brown or blackish. Antenodal subcostal cross-veins pale.

1. Triangle in fore-wing once crossed, in hind-wing free. [Here also *chrysostigma*, *guineense*, *abbotti*.]
  - a. Penial processes bifid . . . . . *capense*.
  - b. Penial processes not bifid, sublanceolate . . . . . [*caffrum*].
2. Triangle in fore-wing twice crossed, in hind-wing usually free but sometimes crossed. Wings suffused greyish yellow . . . *rubens*.

*Orthetrum farinosum* Forster.

1908. Ris, *loc. cit.*, p. 331.

1921. *Id.*, *loc. cit.*, pp. 392, 401, fig. 76.

*Imago*.—Penis ♂. Basal joint shorter than in the other species, not geniculate, but with a pseudo-joint indicated by feebler chitinisation. The 3rd joint bears 2 feebly chitinised, minutely scabrous lobes dorsally (*i.e.* in the position corresponding with the cowl-like process in the other species). On the opposite surface a median recurved lobe, also scabrous. The apex is a membranous, feebly chitinised scabrous lobe, hollowed and cowl-like below, and bearing dorsally just distal to the dorsal lobes a patch of spinules. Vulvar lamina ♀: on either side of the vulva is a small chitinised pocket (one ♀ Waterval). The specimen has no appearance of the pockets being accidental invaginations of the knobs found in other species, but the structure should be confirmed.

*Remarks*.—This species is at once distinguished by the nearly parallel-sided abdomen, without basal enlargement and constriction. The wing tips are suffused in ♀. The penis of the ♂ and the vulvar lamina ♀ (if the latter is confirmed) are notably different from those of any other species examined.

It seems to be rare in the S.W. Cape, but has been observed on Kalk Bay Mts., Cape Peninsula (A. C. H., December 1931).

*Orthetrum capense* Calvert.

1893. Calvert, Proc. U.S. Nat. Mus., vol. xvi, p. 584, fig. 3.

1921. Ris, *loc. cit.*, p. 395 (*caffrum* part: ♂ from Worcester).

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 486.

*Imago*.—Regularly one row of cells IR<sub>3</sub>–Rspl, with occasional double cells. Hamule corresponding closely with Ris's figure 75 of that of a Zululand specimen of *stemmale*, but the inner uncinatate lobe rather broader and more robust, its inner anterior surface setose.

Apex of anterior lamina broadly rounded, without trace of notch. Lateral processes at apex of penis strongly bifid.

Antenodal subcostal cross-veins pale ochreous to brown. Superior appendages ♂ and anal appendages ♀ dark brown on emergence from nymph, becoming black in mature specimens. Thoracic pattern: a dark ante-humeral stripe midway between median crest and humeral suture; the latter with a dark stripe; mesepimeron with a broad pale stripe, bordered below by a dark stripe which is slightly anterior to the 1st lateral suture; a second, less distinct, pale stripe on the metepimeron immediately below the 2nd lateral suture. Abdomen with medio-dorsal and lateral keels dark or blackish, an ill-defined dark lateral stripe from segments 3 or 4 to 9; segment 10 blackish. In fully mature specimens the abdomen is bluish pruinose, and the thoracic pattern is more or less obscured.

*Nymph.*—Up to 18–20 mm. Body and legs densely setose. Antennae moderately long, in length  $1\frac{1}{2}$  times distance between their bases. Abdomen in dorsal view regularly oval, greatest width not quite twice in length (incl. anal pyramid). Very small lateral acute points on segments 8 and 9. A slight medio-dorsal keel on segments 4–6, ending on each segment in small teeth, much obscured by setae, that on segment 6 being the most conspicuous. Anal pyramid subequal to segments 9 plus 10; appendix dorsalis and cerci subequal in length, cercoids  $\frac{2}{3}$  length. Mandibles similar to those of *Helothemis* (fig. 30, *k*), but apical teeth 3 and 4 coalesced in right mandible, and no indication of the anterior marginal denticle. Mask in repose extending to coxae of fore-legs. Median lobe with front margins straight, feebly crenulate, with a short blunt spinule in each indent, a small blunt median projection, not prominent but distinct; lateral lobes with about 8 very shallow indents, 4–5 spinules (usually 2 large, 2 small) near each indent. Lateral setae 6, median setae 3 long and about 14 short, the latter curving forwards towards the median line. Legs with divided spines on fore tibia and hind tarsus; 1st and 2nd joints of tarsus with blunt spines in anterior row in fore and mid legs and in posterior row in hind leg. Dorsal teeth of gizzard with a few large subsidiary denticles. Rectal gills with about 30 lamellae in each hemibranch. Uniform dark brown. Rectal gills greyish or slightly mauve tinted.

*Localities.*—Widely distributed over the S.W. districts, including the Cape Peninsula.

*Remarks.*—Ris (Coll. Selys. Libellulinae, fasc. x, 1909, p. 216) mentions a dark ♂ from Cameroon with suffused yellowish brown

superior appendages, and another very dark ♂ with black appendages. In immature examples the appendages are whitish. In all the S.A. Museum examples (♂ and ♀) the appendages are pale yellow. The antenodal subcostal cross-veins, even in very immature specimens, are black (Ris, 1921, *loc. cit.*, p. 400). Calvert's ♂ was partly pruinose, and he states that the superior appendages were black. The subcostal cross-veins are not specially mentioned ("reticulation blackish").

The Cape form here described has constantly pale subcostal cross-veins, even in dark mature specimens; at most they become slightly brownish near their junctions with Sc and R. The appendages (♂ and ♀) in freshly emerged specimens are always dark brown, becoming later black. There can be no reasonable doubt that this form and Calvert's single ♂ are identical.

I suggest therefore that the name *capense* (if the rules of nomenclature allow it—see Ris, 1908, p. 330, and 1909, p. 215) be retained for this Cape form characterised by dark appendages and pale subcostal cross-veins; and that the more tropical form (specimens from Zululand, Lorenzo Marques, and Pretoria, identified by Ris in S.A. Museum), characterised by pale appendages and dark cross-veins, be regarded as a separate race under another name (*cf.* Ris, 1909, p. 216).

*Habits.*—This species is one of the commonest Libellulids in the Cape districts. In the neighbourhood of Cape Town the imagos are on the wing from September to April.

The nymphs burrow in mud and decaying vegetable debris in more or less stagnant pools and slow-running streams. They crawl up the bank, or up rocks and rush stalks before emergence.

*Orthetrum rubens* n. sp.

*Imago.*—Triangle in fore-wing twice crossed (on both sides in 6 specimens), once crossed (on both sides in 1 specimen), once on one side and twice on the other (3 specimens), twice on one side and thrice on the other (1 specimen); in hind-wing crossed in 3 specimens, on one side only (1 specimen). Supra-triangle in fore-wing (Ris: *ht*) normally with one cross-vein, occasionally 2 on one side, or no cross-vein at all on one side. Arculus very slightly proximal to 2nd Anq in 7 specimens, at 2nd Anq in 2, and distal in 2 specimens. A single Ac. 13–15 Anq in fore-wing, 10 (sometimes 9) in hind-wing. Three rows of cells in discoidal field (between MA and Cu<sub>2</sub>) in fore-wing,

sometimes 4 or even 5 at the beginning, but, if so, usually asymmetrical. In both wings 2 rows of cells between  $IR_3$  and  $Rspl$ , though in one case there are only 2 double cells in each hind-wing, 3 in one of the fore-wings, 4 in the other. One row between  $MA$  and  $Mspl$ .  $Cu_2$  in hind-wing at (6 specimens) or separated from (5 specimens) anal angle of triangle.

Genitalia ♂: Anterior lamina feebly notched at apex, its anterior surface with stout spinules and a few long setae; hamule with inner and outer lobes nearly equally developed, both strongly chitinised, the inner with acute out-turned apex, lobes rather widely separated. Penis with lateral apical projections sublanceolate as in *caffrum* (fig. 26, c). Vulvar lamina ♀ as in *capense* (fig. 26, j).

Abdomen: ♂ 28–29, ♀ 29–30 mm. Hind-wing; ♂♀ 29–31 mm.

Lateral lobes of labium, labrum, clypeus, frons, and occiput gamboge, often deep orange; median lobe of labium more or less suffused. Vertex shiny black. Lobe of prothorax gamboge, its dorsal margin dark brown. Thoracic dorsum ruby red in life, dull orange brown when dried, suffused with darker brown along median crest, especially anteriorly; an ante-humeral dark brown stripe about midway between crest and humeral suture, disconnected at both ends; humeral suture dark brown or blackish followed by a broad pale yellow or whitish stripe occupying about half width of mesepimeron; 2nd lateral suture dark brown or blackish followed by a second pale whitish stripe on the metepimeron; rest of mes- and met-epimeron and sternum ruby red in life (orange brown when dried), like the dorsum but becoming paler ventrally. Abdomen orange, the dorsal and lateral keels and the subsidiary keels on segments 2 and 3 black; a black lateral stripe from segment 1, connected with its fellow across the posterior margins of segments 4–8; segments 9 and 10 black, with dull orange marks in ♀, usually not visible in ♂; ventral surface from 3rd segment black or in ♀ dark brown. Superior and inferior appendages ♂, and anal appendages ♀ black, the inferior appendage ♂ dull orange brown in centre. Legs black, the femora ochreous at base, especially in fore-legs; in ♀ the ochreous parts are more extensive on all the femora. Wings more or less strongly suffused with greyish or smoky yellow, the first postnodal costal cell usually remaining hyaline; the suffusion densest towards the costal and pterostigmal areas. A bright orange spot at base of both wings, that on hind-wing more extensive, and sometimes reaching to the arculus, less marked in ♂ than in ♀. Costa pale yellow in front. Pterostigma deep yellow between narrow

black veins. Venation dark brown except the antenodal subcostal cross-veins which are pale luteous. Membranule grey. In general, ♀♀ are not so dark as ♂♂; in some of the latter a faint pruinosity is developed on the dorsal surface of the abdomen.

*Localities.*—Kirstenbosch Botanic Gardens, Cape Town (R. F. Lawrence, January 1923, 1 ♂, 4 ♀♀); Gt. Winterhoek Mts., Tulbagh (K. H. B. and H. G. W., November 1932, 3 ♂♂, 2 ♀♀); Michell's Pass, Ceres (A. J. Hesse and H. G. W., October 1934, 2 ♀♀); Tradouw Pass, Langeberg (K. H. B., January 1935, 1 ♀); French Hoek Pass (K. H. B. and C. W. T., October 1936, 1 ♀).

*Remarks.*—This very striking dragon-fly resembles *caffrum* in the structure of the penis, and in having 2 conspicuous whitish lateral stripes on the thorax. But the twice-crossed triangle in fore-wing, the hamule, and the strong suffusion and greater extent of orange basal spot on the wings seem to indicate a separate species. In life the ruby-red tints on the thorax are a noticeable feature.

Gen. *Palpopleura*, Rambur.

1921. Ris, *loc. cit.*, pp. 385, 401.

1936. Fraser, *loc. cit.*, p. 316.

*Imago.*—Arculus proximal to 2nd Anq. More than 10 Anq, the last one in fore-wing incomplete. Sectors of arculus with common



FIG. 27.—*Palpopleura jucunda* Rambur, ♂ genitalia. *a*, lateral view of left side 2nd segment showing anterior lamina (*a.l.*), posterior hamule (*p.h.*), and genital lobe. *b*, ventral view of anterior lamina and posterior hamules. *c*, one of the latter flattened out. *d*, penis, with ventral process and lateral processes in ventral view.

stalk. Costa in fore-wing indented about half-way between base and nodus. Discoidal field in fore-wing beginning with 3 rows of cells. Triangle transverse in fore-wing, crossed in both wings (once



or twice). One or two Ac in hind-wing. Lobe of prothorax moderate. Abdomen short, depressed. Wings variegated with black and yellow.

*Palpopleura jucunda* Rambur.

1908. Ris, *loc. cit.*, p. 331.

1921. *Id.*, *loc. cit.*, pp. 402, 404, pl. x, figs. 9, 10.

1929. Brain, *loc. cit.*, p. 158.

*Localities.*—Knysna (recorded by Kirby); Stellenbosch (Brain); Ceres (R. M. Lightfoot, December 1912); Tradouw Pass, Langeberg Range, east of Swellendam (A. J. Hesse, November 1925); French Hoek Pass (K. H. B. and C. W. T., October 1936); River Zonder End, near Greyton, Caledon Div. (H. G. W., December 1931); Gt. Winterhoek Mts., Tulbagh (K. H. B. and H. G. W., November 1932); Bosch Kloof, Clanwilliam (K. H. B. and C. W. T., September 1936).

*Remarks.*—This unmistakable dragon-fly, with its mottled wings, appears to be local, but occurs both at low levels as well as high up in the mountains. The nymph has not yet been discovered.

Gen. *Crocothemis* Brauer.

1921. Ris, *loc. cit.*, pp. 386, 410.

1921. Rousseau, *loc. cit.*, p. 140 (nymph).

1936. Fraser, *loc. cit.*, p. 343.

*Imago.*—Arculus proximal to 2nd Anq. More than 10 Anq in fore-wing, the last one incomplete. Sectors of arculus with common stalk. Triangle in fore-wing transverse, crossed, in hind-wing free. One Ac in hind-wing. Discoidal field in fore-wing beginning with 3(-4) rows of cells. One row of cells between IR<sub>3</sub> and Rspl.

*Nymph.*—Body nearly glabrous. Legs moderately long. Antennae inserted a little in advance of level of anterior margin of eyes, which are large and prominent. Lateral margins of head behind eyes strongly convergent. Abdomen oboval, abruptly narrowed posteriorly, without medio-dorsal tubercles; segments 8 and 9 with short lateral points. Lateral lobes of mask with numerous very shallow indents. Gizzard as in *Orthetrum*.

*Crocothemis erythraea* (Brulle).

1921. Ris, *loc. cit.*, pp. 412, 414.

1921. Rousseau, *loc. cit.*, p. 140, figs. 34, *d* and 35, *d* (nymph).

*Imago.*—In addition to the characters given by Ris for differentiating this species from *sanguinolenta*, the penis also shows slight

differences. The distal joint is shorter in *erythraea*, the lateral clasper-like projections larger, the apical process dorso-ventrally flattened, semi-spatulate, without membranous lateral lobes.

*Nymph*.—Up to 18–20 mm. Antennae slender, but only very slightly longer than distance between their bases. Abdomen widest across segment 7. Short acute lateral spines on segments 8 and 9.

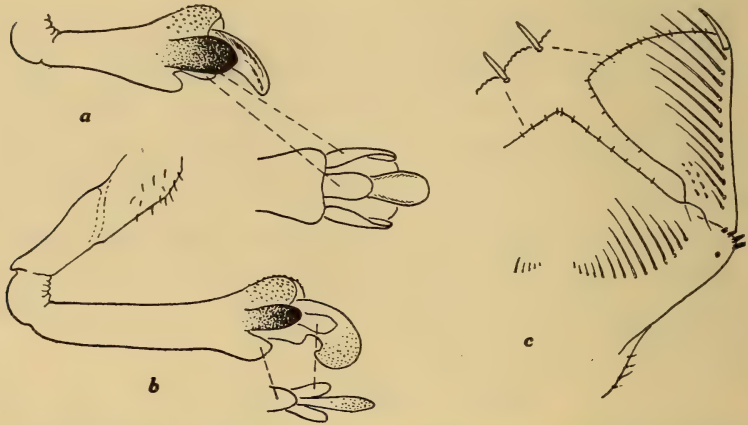


FIG. 28.—*Crocothemis*. Imago: *a*, penis of *erythraea*, with apex in ventral view. *b*, the same of *sanguinolenta*. Nymph: *c*, portion of mask of *erythraea*, with margins of median and lateral lobes further enlarged.

Dorsal surface without any medio-dorsal keel or tubercles. Cerci and appendix dorsalis subequal in length, cercoids  $\frac{2}{3}$  length. Mandibles as in *Helothemis* (fig. 30, *k*), the anterior marginal denticle in right mandible present or absent. Mask extending to middle coxae. Median lobe with margins straight (or almost so), with feeble indents, with a spinule in each, the whole margin very minutely crenulate. Distal margin of lateral lobes similar, about 12 indents, sometimes 1 spine at each indent, sometimes 1 larger and 1 smaller. Lateral setae 11–12, mental setae 14–16. Armature of legs as in *Helothemis* (fig. 30, *l*), divided spines on fore and mid tibiae and all the tarsi. Rectal gills with about 40 lamellae on each hemibranch.

*Localities*.—Widely distributed over the S.W. Cape area, including the Cape Peninsula.

*Crocothemis sanguinolenta* Burm.

1921. Ris, *loc. cit.*, p. 413, pl. xi, fig. 3.

*Imago*.—The comparatively coarse serration of the lateral keels of the abdomen, and the black spots in the middle of the lateral

margins of segments 4-7 are good differential characters; but the most conclusive character is the penis.

*Localities*.—French Hoek Pass (H. G. W., October 1933, 1 ♂); Tradouw Pass, Langeberg Range (H. G. W. and C. W. T., January 1935, 2 ♂♂).

*Remarks*.—Much rarer in the S.W. Cape than *erythraea*, the above being the only specimens which have come to hand.

Gen. *Sympetrum* Newman.

1921. Ris, *loc. cit.*, pp. 387, 417.

1921. Rousseau, *loc. cit.*, p. 141 (nymph).

1936. Fraser, *loc. cit.*, p. 370.

*Imago*.—Arculus proximal to 2nd Anq. Less than 8 Anq, of which the last one in fore-wing is incomplete. Sectors of arculus with common stalk. Triangle in fore-wing transverse, crossed, in hind-wing free. One Ac in hind-wing. Discoidal field in fore-wing beginning with 3 rows of cells, narrowing towards margin. One row of cells between IR<sub>3</sub> and Rspl. Lobe of thorax large, bilobate, setose. ♀ with prominent vulvar flaps.

*Nymph*.—Body glabrous or sparsely setose. Legs long and thin. Head large, eyes prominent, lateral margins behind eyes convergent. Antennae inserted a little in advance of level of anterior margin of eyes. Mask extending to coxae of middle legs; lateral lobes warty, with very shallow indents. Abdominal segments 8 and 9 with strong lateral spines; medio-dorsal projections small.

*Sympetrum fonscolombi* Selys.

1917. Tillyard, *loc. cit.*, p. 345, fig. 176 C (2nd abd. seg. ♂).

1921. Ris, *loc. cit.*, p. 417, pl. xi, fig. 4.

? 1929. Brain, *loc. cit.*, p. 158, fig. 76 (nymph).

1936. Fraser, *loc. cit.*, p. 377, fig. 106, *b* (2nd abd. seg. ♂).

*Remarks*.—This dragon-fly, easily recognised by the few antenodal cross-veins, is widely distributed in the S.W. Cape, including the Peninsula.

Its nymph has not yet been discovered in South Africa. Adults have been observed ovipositing, and teneral specimens have been captured at Stellenbosch (A. C. H.); large numbers of likely nymphs (*i.e.* those with large points on sides of segments 8 and 9) have been bred without success. It is extremely doubtful whether

the nymph figured by Brain belongs to this species; it looks far more like that of a *Crocothemis*.



FIG. 29.—*Sympetrum fonscolombei* Selys. Penis with apical portion in ventral view.

In Europe the species is well known to be migratory, and this explanation might be adopted to account for the failure to obtain the nymphs, if it were not for the teneral specimens mentioned above.

#### Gen. *Helothemis* Karsch.

1921. Ris, *loc. cit.*, pp. 388, 419.

1936. Longfield, *Trans. Roy. Entom. Soc.*, vol. lxxxv, p. 489.

*Imago*.—Like *Trithemis* (*infra*), but last Anq in fore-wing complete. Penis of the same type as in *Trithemis*. Black lateral stripes of thorax not fused into an horizontal band.

*Nymph*.—Body nearly glabrous. Legs moderately long. Antennae inserted a little in advance of level of anterior margin of eyes, which are large and prominent. Lateral margins of head behind eyes convergent. Abdomen medio-dorsally keeled; segments 8 and 9 ending in short lateral points. Lateral lobes of mask with several shallow indents. Gizzard as in *Orthetrum*.

#### *Helothemis dorsalis* (Rambur).

1898. Kirby, *Ann. Mag. Nat. Hist.* (7), vol. ii, p. 236 (*Stoechia distanti*).

1921. Ris, *loc. cit.*, p. 419.

1923. Champion, *Ann. Mag. Nat. Hist.* (9), vol. xii, p. 673, (♂ accessory genitalia) (*Trithemis distanti*).

1936. Longfield, *loc. cit.*, p. 490, fig. 8, c (♂ accessory genitalia).

Penis (fig. 30, *f*). Anterior lamina (see Longfield's figure) with subapical tuft of rather long hairs, and spines on the anterior surface.

Posterior hamule (fig. 30, *g*) (see also Champion's and Longfield's figures) with small apical hook and semicircular excision.

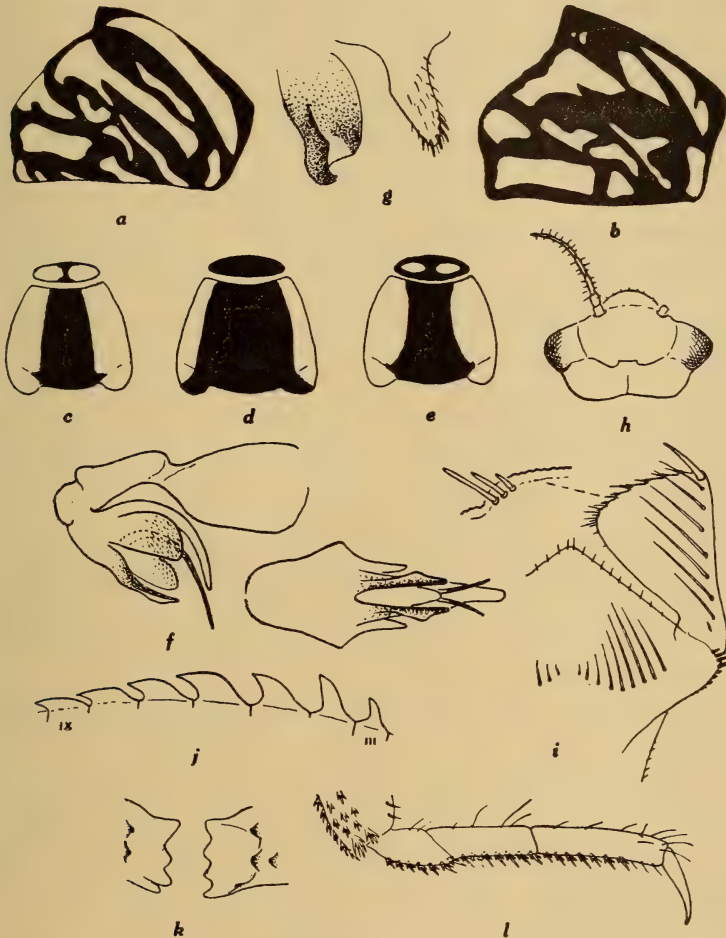


FIG. 30.—*Helothemis dorsalis* (Rambur). Imago: *a*, *b*, lateral diagrammatic view of thorax of typical form, and Silvermine Valley form respectively. *c*, *d*, labium and labrum, ♂ and ♀ respectively, of typical form. *e*, the same (♂ and ♀) Silvermine Valley form. *f*, penis, with apical portion in ventral view. *g*, posterior hamule and genital lobe, 2nd segment ♂. Nymph: *h*, head. *i*, portion of mask with margin of lateral lobe further enlarged. *j*, profile of abdominal segments 3-9. *k*, inner view of apices of mandibles (right mandible on right, anterior margin above). *l*, anterior surface of tarsus and apex of tibia of fore leg.

*Imago*.—Labrum ♂ black, ♀ yellow. Labium in ♂ with very broad black median band, the yellow confined to the lateral margins, and

sometimes restricted to the anterior corners; in ♀ the black band is much narrower. Thoracic markings in ♀ and immature ♂ sharply defined without any tendency to fusion and the formation of a longitudinal dark band along the side; dorsally the ante-humeral yellow ground colour extends the whole length of mesepisternum. Abdominal segment 9 with pale cuneiform marks (continuing those on the preceding segments). Adult ♂ thorax and abdomen dark blue, pruinose.

*Nymph.*—Up to 17–18 mm. Body sparsely setose. Legs rather long and slender. Antennae slender, twice as long as distance between their bases. Abdomen broadly oval, greatest width across segment 6 slightly more than half length of abdomen (including anal pyramid). Segments 8 and 9 ending in short acute lateral points. Segments 3–9 medio-dorsally keeled, the keel produced in strong upstanding tooth-like processes, that on segment 6 being the largest. Anal pyramid slightly longer than segments 9 plus 10, cerci subequal to appendix dorsalis, which is dorsally keeled, cercoids scarcely half length of latter. Mandibles (fig. 30, *k*): Mask extending to between coxae of middle legs; median lobe with straight anterior margins; lateral with about 8 feeble indents, with 3 graduated spines near each indent, inner angle with several unequal spines; mental setae 9–10, lateral setae 6–7. Divided spines on fore and mid tibiae and all the tarsi (fig. 30, *l*). Rectal gills with 25–30 lamellae on each hemibranch.

Greenish brown, semi-transparent, more or less mottled, femora banded.

*Localities.*—Table Mt., Cape Town (K. H. B. and H. G. W., December–March); Kalk Bay Mts. (A. C. H., November–March; Groot Drakenstein (A. C. H., March); French Hoek Mts. (K. H. B. and H. G. W., December); Hottentots Holland Mts. (K. H. B. and H. G. W., January); Houw Hoek Mts. and Bot River (K. H. B., January 1937); Caledon (T. D. Butler, December 1894).

*Remarks.*—Neither the ante-humeral stripe, nor the labium (♂), nor the 9th abdominal segment are decisive in separating this species from *Trithemis risi*. The dark lateral thoracic band and the incomplete last Anq as a rule serve to distinguish the latter species (see Ris, *loc. cit.*, p. 420), which also has a paler blue pruinosity in old ♂♂; there are, however, cases in which one or other of these characters is not constant. An incomplete extra Anq may be developed, fusion of the thoracic stripes into a dark longitudinal band, and reduction of the ante-humeral yellow stripe to the anterior half, are liable to occur in ♀♀.

In the Silvermine Valley, the upper waters of which are dammed to form the Muizenberg Reservoir (Lakeside Plateau, Kalk Bay Mts.), there seems to be a colony which at first was considered to be *Trithemis risi* or *stictica*. Only a few specimens have been closely examined (2 ♂♂, 2 ♀♀), but they all show the incomplete last Anq (sometimes oblique and disconnected either from C or Sc) ( $10\frac{1}{2}$ – $13\frac{1}{2}$  ♂,  $9\frac{1}{2}$  ♀), the horizontal thoracic stripe, and both sexes have 2 yellow spots on the labrium (larger in ♀ than in ♂). The penis, however, agrees exactly with that of *H. dorsalis*.

Typical *dorsalis* also occurs in the same locality, and the nymphs of the two forms are indistinguishable.

Gen. *Trithemis* Brauer.

1921. Ris, *loc. cit.*, pp. 387, 420.

1936. Fraser, *loc. cit.*, p. 381.

*Imago*.—Arculus proximal to 2nd Anq. More than 10 Anq, the last one in fore-wing incomplete. Sectors of arculus with common

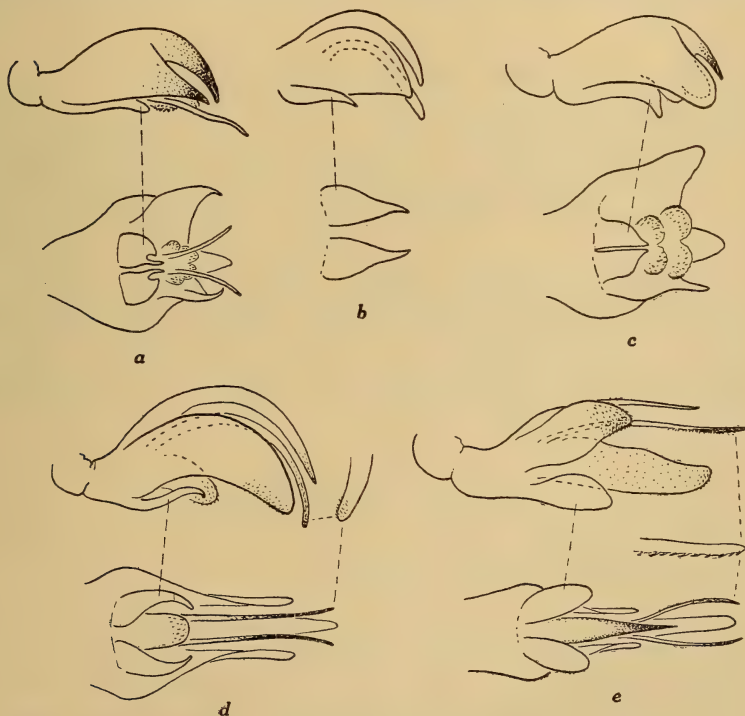


FIG. 31.—*Trithemis*, apices of penes of: *a*, *ardens*. *b*, *aureola* (Inhambane). *c*, *arteriosa*. *d*, *stictica* (Rhodesia). *e*, *risi*, with ventral views (ventral paired processes alone in *b*). In *a* and *c* the left lateral process is turned outwards.

stalk. Triangle in fore-wing crossed. One Ac in hind-wing. Discoidal field beginning with 3 rows of cells, narrowing to wing margin. Two rows of cells between  $IR_3$  and  $R_{spl}$  (often only a few double cells).

Penis with the terminal joint broad and dorso-ventrally flattened, dorsal process elongate, spatulate, chitinised, usually strongly curved; lateral clasper-like processes large or very large; a pair of ventral scale-like or elongate processes, a pair of more or less curved slender rod-like processes ("titillators") arising from the base of a membranous lobe.

*Nymph.*—(*arteriosa*) as in *Helothemis*.

*Remarks.*—The penes of *ardens*, *arteriosa*, *aureola*, *risi* (= *distanti* Ris, 1921), and *stictica* have been examined, and all of them agree in type of structure, except that the rod-like processes are absent in *arteriosa*.

One specimen of *annulata* (Kaapmuiden, identified by Ris) has also been examined, but the penis is of quite a different type, resembling that of *Crocothemis*.

#### Key to the S.W. Cape species.

1. Colour predominantly red.
  - a. General colour maroon or dark red. Frons dorsally and vertex of ♂ violaceous coppery, of ♀ ochreous red. Thorax ♂ dorsally deep mauve or violaceous, ♀ golden brown. Abdomen ♂ blood red, ♀ more ochreous. Legs all black. Small golden spots at bases of wings  
*arteriosa*.
  - b. General colour scarlet or orange-red. Frons ♂ scarlet dorsally, ♀ paler. Thorax reddish brown or olivaceous. Abdomen ♂ scarlet, ♀ ochreous. Fore and mid femora ochreous. Large golden spots at bases of wings  
*ardens*.
2. Colour predominantly black and yellow, ♂ blue pruinose, with metallic violet frons and vertex . . . . . *risi*.

#### *Trithemis arteriosa* (Burm.).

1908. Ris, *loc. cit.*, p. 337.

1921. *Id.*, *loc. cit.*, pp. 421, 423, 425.

*Imago.*—Penis ♂. Lateral processes large, broad, wing-like when expanded; ventral processes sublanceolate, the inner margins straight, separated by a narrow cleft; dorsal process comparatively short; no rod-like processes arising from the membranous central portion which is divided into 4 lobes.



*Nymph*.—Indistinguishable from that of *Helothemis dorsalis*.

*Localities*.—Widely distributed over the S.W. Cape, including the Cape Peninsula.

*Trithemis ardens* (Gerst.).

1908. Ris, *loc. cit.*, p. 338.

1921. *Id.*, *loc. cit.*, pp. 421, 423, 426 (*kirbyi ardens*).

*Imago*.—Penis ♂. Lateral processes large, rather acutely pointed; ventral processes ovate, with sharp point on inner apex, flanked by a notch on outer margin; dorsal process moderately elongate; 2 rod-like processes arising from the membranous central portion which is divided into 4 lobes.

*Locality*.—Kogman's Kloof, Montagu (K. H. B. and H. G. W., January 1935). Calvinia (K. H. B. and C. W. T., September 1936). Also Aiais on Gt. Fish River, S.W.A. (A. J. H. and C. W. T., November 1936).

*Trithemis risi* Longfd.

1908. Ris, *loc. cit.*, p. 339 (*T. distanti* non Kirby).

1921. *Id.*, *loc. cit.*, pp. 422, 424, 427, pl. xi, fig. 5 (wings). (*T. distanti* non Kirby.)

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 490, fig. 8, a (♂ accessory genitalia).

*Imago*.—Penis ♂. Lateral lobes moderately large, ovate; ventral lobes also ovate, apices rounded, somewhat irregularly and feebly crenulate; dorsal process slender, not strongly curved; rod-like processes nearly straight, arising from base of a long, prominently projecting central lobe, the latter being chitinised on either side, but membranous dorsally and ventrally in its basal portion. Hamule larger and with a wider semicircular excision than in *Hemithemis dorsalis*. Anterior lamina with a subapical tuft of short bristles, and no spines on anterior surface (see Longfield's figure).

Anq ♂  $10\frac{1}{2}$ – $11\frac{1}{2}$ , ♀  $9\frac{1}{2}$  (Cape specimens); ♂♀  $10\frac{1}{2}$ – $13\frac{1}{2}$  (Transvaal and Rhodesian specimens).

*Localities*.—Widely distributed in the S.W. Cape districts, but not yet found on the Cape Peninsula.

*Remarks*.—In ♂♂ the penis, hamules, and anterior lamina serve at once to distinguish this species from *Helothemis dorsalis*.

Gen. *Pseudomacromia* Kirby.

1921. Ris, *loc. cit.*, pp. 387, 428.

*Imago*.—Arculus proximal to 2nd Anq. 10–12 Anq in fore-wing, the last one incomplete. Sectors of arculus with common stalk. Triangle in fore-wing crossed. One Ac in hind-wing. Discoidal field beginning with 3 rows of cells, parallel-sided to wing margin. Anal loop very long. Pterostigma comparatively small.

*Nymph*.—See *infra*.

*Remarks*.—The Ceres specimen of *torrida* is a ♀, but by a printer's error was recorded as a ♂ in Ris's monograph. This specimen and a ♀ from George have only 1 row of cells between IR<sub>3</sub> and Rspl; the M'fongosi ♀ has only 1 double cell in each wing. One (♀) out of four specimens (2 ♂♂, 2 ♀♀) from Palmiet River has 1 double cell in fore-wing of one side, 2 in hind-wing of same side; on the other side only a single row as in all the wings of the other three specimens. The ♀ from Hottentots Holland Mts. has 1 double cell in 1 fore-wing only.

All the Cape specimens have 3 rows of cells between A<sub>3</sub> and wing margin, except the Ceres and Hottentots Holland Mts. specimens, both of which have an incomplete 4th row on one side only.

The character of the tarsal claws seems to be more a sexual than a specific character; and the differences in the tibial spines, mentioned by Ris, I am unable to appreciate.

I think it very doubtful if *natalensis* can be maintained as a distinct species, and I record all the Cape specimens under Kirby's name, with the comment that, as regards the anal area in hind-wing and the IR<sub>3</sub>-Rspl cells, they correspond with *natalensis* in Ris's key.

The penis of the M'fongosi ♂ (identified by Ris as *natalensis*) corresponds with that of the Cape specimens.

*Pseudomacromia torrida* Kirby.

1889. Kirby, Trans. Zool. Soc. London, vol. xii, pp. 299, 340, pl. lii, fig. 7.

1908. Ris, *loc. cit.*, p. 341.

1921. *Id.*, *loc. cit.*, p. 429.

*Imago*.—Penis ♂. Terminal joint heavily chitinised, dorsally with a large wing-like lobe on either side of a median membranous, globose, and scabrous lobe, supported internally by a chitinous

framework which ventrally bears a pair of strongly spinulose processes. Below these latter a plate, chitinised on either side, but with membranous tip; ventrally a pair of strongly chitinised, short, rod-like projections.

*Nymph*.—Up to 24–25 mm. Body smooth except for very fine

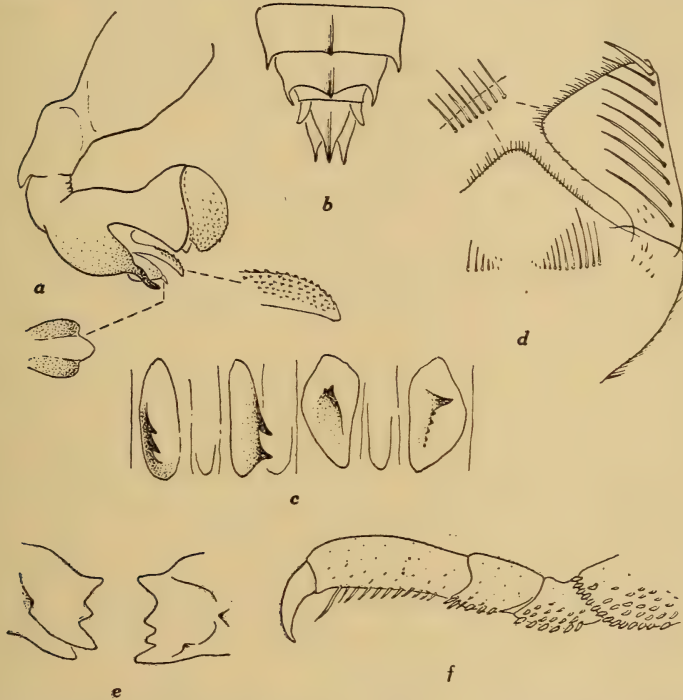


FIG. 32.—*Pseudomacromia torrida* Kirby. Imago: *a*, penis, with apex of one of the paired processes further enlarged, and ventral view of the median ventral plate. Nymph: *b*, dorsal view of 8th–10th abdominal segments and anal pyramid. *c*, gizzard opened out, the 2 ventral teeth on left, the 2 dorsal ones on right. *d*, portion of mask, with margin of median and lateral lobes further enlarged. *e*, inner view of apices of mandibles. *f*, anterior surface of tarsus and apex of tibia of fore-leg.

pilosity. Legs long and relatively slender. Eyes large and prominent. Antennae inserted slightly in advance of level of anterior margin of eyes, very short, slightly shorter than distance between their bases. Lateral margins of head behind eyes convergent. Abdomen ovate, broadest across segments 6 and 7. Segments 8 and 9 with strong lateral acute spines. Segments 3–9 medio-dorsally keeled, the keel produced in upstanding tooth-like processes, similar to, but relatively smaller than, those of *Helothemis dorsalis*. Anal pyramid a little

longer than segments 9 plus 10, cerci subequal to appendix dorsalis, which is dorsally keeled, cercoids  $\frac{1}{3}$  to nearly  $\frac{1}{2}$  length of latter. Mandibles with only a single knob-like tooth (fig. 32, e). Mask very short, extending only to between coxae of fore legs. Median lobe with rather broadly rounded apex and slightly concave margins, set with somewhat unequal spines (more or less alternately long and short); lateral lobes with distal margin without any trace of indents, set with unequal spines. Mental setae 9-10, with a few irregular small ones near median line, lateral setae 8. Legs without any divided spines, armature on anterior surface of fore and mid legs, and on posterior surface of hind leg as in fig. 32, f. Gizzard with 2 strong denticles on the ventral teeth, a single one on each of the dorsal teeth, the apex sometimes bifid, and sometimes 2-3 little denticles on the posterior edge of the large tooth. Rectal gills lamellate, about 50 lamellae to each hemibranch.

Brown, with a more or less distinct greenish tinge; rectal gills white.

*Localities*.—Ceres (Ris, ♀, printed in error as ♂); Palmiet River, near Kleinmond (H. G. W., December 1932, 1933; K. H. B., December 1934); Hottentots Holland Mts. (K. H. B. and H. G. W., January 1933); Berg River, Groot Drakenstein (K. H. B., March 1931, nymph shuck); Kaaiman's River, George District (H. G. W., April 1933, nymph shuck, and January 1936, 1 ♀).

*Remarks*.—Correlated by means of a teneral ♀ just emerged from its shuck (H. G. W., Palmiet River, December 1933). In mid December 1934 the shucks were very common on the rocks and on the stems of the Palmiet (*Prionium*) in the same locality, and the imagos were flying on the slopes of the nearby hills. A few living nymphs were still to be found amongst the submerged stems and roots of the palmiet, and other vegetation.

#### Gen. *Pantala* Hagen.

##### *Pantala flavescens* (Fabr.).

While this paper was in the press, this dragon fly, and its nymph, has been found within the S.W. Cape region, viz. Letjesbosch, Beaufort West, and Olifants River, Clanwilliam.

A figure of the nymph is given by Needham (1904, Proc. U.S. Nat. Mus., xxvii, p. 712, pl. 40, fig. 5). A fuller description, with figures, of the South African nymphs will be given on another occasion.